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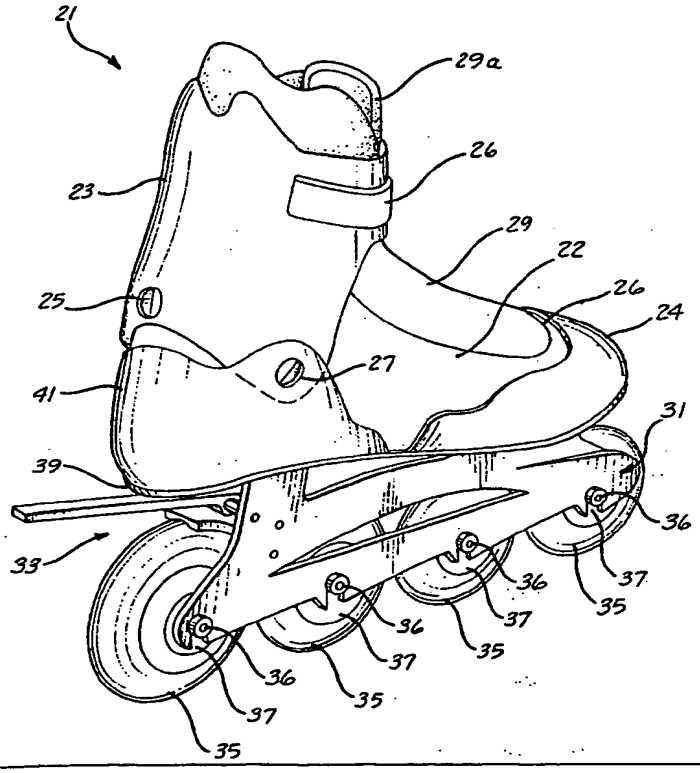
(54) Title: IN-LINE ROLLER SKATE

(57) Abstract

An in-line roller skate (21) incorporating a soft, breatheable upper (22) and exoskeletal support structure is disclosed. The skate includes multiple in-line wheels (35) secured to a frame (31). The frame is attached to a base (39). In one disclosed embodiment the frame is integrally molded with the base. In another embodiment, the frame is adjustably attached and may be moved both laterally and longitudinally with respect to the base. A hook-and-peg (237, 238) alignment means for accurately securing the frame to the base is also provided. A toecap (24) and heel counter (41) project upwardly from the base and help support the upper. A cuff (23) is pivotally attached to the heel counter and includes a strap (228) for tightening the cuff around the leg of the skater. A speed control device (33) is also disclosed that includes a friction plate (61) to contact the wheels in response to movement of a lever (59).



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IN-LINE ROLLER SKATE

Field of the Invention

The present invention relates generally to in-line roller skate boots for securely holding and supporting the skater's foot and, more particularly, to in-line roller skate boots having special boot construction to reduce rigid materials surrounding the skater's foot.

Background of the Invention

In-line roller skate boots generally include a boot upper, an insole, and a base all mounted on a frame carrying a plurality of wheels that are mounted in-line, one behind the other, rotatable in a common, longitudinally extending, plane of rotation. The boot upper is shaped to fit around the wearer's foot and ankle and may include lacing, buckles, straps, and/or other securing arrangements, a tongue, and/or a toe cap, all providing support for the skater's foot. The lower frame of the in-line roller skate provides the rigid substructure or undercarriage for supporting the boot upper and the in-line roller skate wheels.

To obtain the optimum performance from an in-line roller skate, it is important that the in-line roller skate be maintained in a substantially vertical position. In this regard, the boot upper of the in-line roller skate serves competing purposes of providing support and comfort; comfort in a boot upper not usually being associated with a high degree of support. In other words, the incorporation of rigid support structures in the boot upper tends to add stiffness and bulk, and, considering the warm-weather environments conducive to in-line roller skating, tends to make the skate, heavy, hot, and uncomfortable. Because serious ankle and other injuries can

result if comfort is favored over support, providing proper support in an in-line roller skate boot upper has been the dominant design criterion in the past.

Often the boot upper is constructed of a molded plastic shell that includes the base, the plastic shell is usually a rigid, nonbreatheable material. The plastic material of the shell generally forms the outer structure of the boot upper, providing any necessary support to the ankle of the wearer. And, because the plastic shell is rigid, a separate soft inner liner of sponge rubber or other like material is generally included within the plastic shell to provide a modicum of comfort to the user. The liner, thus, becomes very important with this type of construction to provide adequate padding for foot comfort. Since such soft materials, combined with the rigid plastic shell, are good insulators and do not readily transmit heat or air away from the user's foot, the result is a hot boot upper.

To provide lateral stability, conventional alpine ski boot designs have readily been adapted to in-line roller skates. These boots provide support and durability characteristics necessary for in-line roller skates. U.S. Patents Nos. 4,351,537 and 5,171,033 are both exemplary of rigid injection-molded boots adapted to winter sports, such as ice skating and alpine skiing, which have been modified for in-line roller skating applications. While this type of boot design is well-suited for cold weather sports, the boot upper tends to be hot and uncomfortable when used in warm weather sports, such as in-line roller skating.

In addition, since alpine ski boot designs tend to be rather rigid and unyielding, such designs are not readily adaptable to in-line skating where some flexing is beneficial. In this regard, additional padding is often added to the liner of the in-line roller skate boot to improve comfort, and to allow a single rigid shell to be adaptable to different feet. However, additional padding diminishes skater control over the skate, since this isolates the wearer from the feel of the skate and the skating surface. Further, as additional padding is added, the heel of the skater tends to float up and down within the boot upper so that control is diminished because of the movement of the skater's foot within the boot.

The '033 patent suggests that, by including "primarily unobstructed ventilation ports" in the rigid synthetic outer shell of the boot upper, air can circulate around the skater's foot, thereby eliminating some of the heat associated with the hard plastic outer shell. While this patent seeks to address the issue of comfort, the disclosed boot upper is still configured of two parts, including a hard plastic outer shell and a soft inner liner. In warm weather conditions, the boot can be uncomfortable compared to conventional walking and/or running shoes, due to excessive heat buildup and

perspiration accumulation. The result is that the skater's feet are often hot, damp, and uncomfortable.

Another problem with the adaptation of injection-molded ski-type boots to in-line roller skating is that, while providing excellent lateral stiffness and rigidity for lateral ankle support, these boots also create unnecessary and unwanted forward/rearward stiffness and rigidity. Ski-type boots detract from the performance characteristics of the skate, because they limit the range of motion of the skater's legs and feet and, therefore, the ability of a skater to utilize the full extent of his strength and agility. Racers, for example, prefer lower top skates that are lightweight, flexible, and yet provide lateral ankle support. Currently available boots may be either too high and too stiff in any direction or, on the opposite end of the spectrum, too soft laterally.

Further, it is desirable for in-line roller skate boot uppers to be lightweight. When skating on a flat surface, the in-line roller skater must lift the boot with every stride to provide a forward impetus. Boots that are well-suited to skiing applications, wherein it is not necessary to raise and lower the boot with every movement of the foot (because the skier relies on gravity to provide the forward or downward motion) prove heavy and bulky when adapted to in-line roller skating. The heavy boot upper causes fatigue and reduces skating enjoyment.

Alternative modes of providing both comfort and adequate support for in-line roller skating have been suggested. Specifically, U.S. Patents Nos. 3,963,252; 4,418,929; and 5,069,462 show roller skate frames that include a platform adapted to allow the skater to wear a conventional street shoe that is inserted into a series of braces and supports, generally of a metal construction. These skates offer alternative shoe and frame designs to the rigid plastic outer shell and inner liner of the conventional in-line roller skate. However, significant problems exist with such designs in that the adjustable braces and supports of these designs, while needed to accommodate numerous shoe sizes and shapes, are bulky and uncomfortable. Additionally, there is a limited range of shoe types that the skates will accommodate, and thus, there is the additional requirement that the skater have the proper shoe type to properly utilize the skate.

Because speed beyond that of conventional skating is associated with in-line roller skating, there is a further need for speed control systems on in-line roller skates. Prior solutions to speed control include the placement of bumpers or friction pads on the front or rear of at least one of the skates, allowing the skater to tip or lift his or her foot, either forward or rearward, to bring the bumper into contact with the skating

surface. Accordingly, the skater drags the bumper along until he or she has slowed to a desired speed. While this system has proved satisfactory for paired-wheel roller skates, using pairs of wheels in a side-by-side configuration as the support base, the narrow lateral support base of in-line roller skates makes this braking maneuver difficult. Accordingly, speed control on in-line roller skates employing this type of drag brake requires a high level of skill and coordination to be performed properly. Higher speeds make it difficult for the skater to raise or remove the weight from one foot to properly position the bumper for contact with the skating surface.

U.S. Patent No. 5,067,736 shows a conventional brake adapted for use in in-line roller skating. A pad is retained in a brake housing, the housing being securely fastened to the lower frame portion of the in-line roller skate. Other patents, specifically U.S. Patents Nos. 5,052,701 and 5,028,058, disclose similar braking pads having different configurations mounted on the rear of in-line roller skates. However, in all of these designs, it is necessary for the skater to maneuver or reposition at least one of his feet to properly apply the brake.

Some alternative braking methods have been proposed that apply friction plates or pads to the wheels of the in-line roller skate. U.S. Patent No. 5,171,032 suggests a method of braking by horizontally forcing one or more plates against the in-line roller skate wheel(s). The plates are actuated by a hand control 80, causing brake pads 40 to move substantially horizontally toward in-line roller skate wheel(s) 98.

Braking apparatus used on in-line roller skates must be configured to minimize possible damage to the braking system caused by the user falling or bringing the skate into contact with fixed objects. The design must further avoid debris from becoming jammed in the brake, causing the brake to fail to function and thereby failing to control the skater's speed. More importantly, the brake must be designed to avoid inadvertently jamming against the wheel(s) during skating. It is thus important to position the braking apparatus within the lower frame portion of the in-line roller skate to protect the moving parts of the brake from debris or from being damaged due to impacts.

Another problem with prior art designs for in-line skates involves the need to be able to quickly and easily replace wheels as they become worn. Most current systems require major disassembly of either the lower frame portion or the wheel and mounting axle structure in order to replace a wheel. In this regard, there is a long-felt need for a method of readily replacing or interchanging in-line wheels.

The boots and liners of the present invention were developed to overcome the drawbacks and limitations inherent in prior skate boots. The boots of the present invention provide increased support and comfort, hence, better control due to their construction and the interaction between the soft portions of the boot upper and the various support structures.

Summary of the Invention

In accordance with the present invention, an in-line roller skate is disclosed having a comfortable and soft, pliable, breatheable shoe portion including a base and an ankle support cuff. The shoe portion may incorporate strategically placed rigid and semirigid structures to provide needed support for the skater's foot. The structures may comprise a heel counter integral with the soft, pliable, breatheable shoe portion or be attached to the base portion for connection to the soft, upper portion of the shoe. Further included in the preferred embodiment of the invention is an ankle support cuff hingedly attached to the internal or external heel counter. Arch, heel, and ball supports for the foot may also be provided within the shoe portion, specifically the base portion, to improve the support and comfort of the in-line roller skate.

The ankle support cuff is adjustably attached to the heel counter to provide both lateral and longitudinal adjustment of the ankle support cuff with respect to the base portion. The base portion may be provided with means for attachment to a lower frame portion, generally supporting a plurality of wheels rotatable in a common plane of rotation. The attachment means of the base to the lower frame portion may allow both lateral and longitudinal movement of the upper shoe portion with respect to the lower frame portion. Alternatively, the base and lower frame portion may be a single molded unit.

The present invention may also include a speed control, including a pressure plate above a minimum of one, but preferably two, of the in-line wheels. The pressure plate is biased away from the in-line wheels in a substantially vertical direction. Upon actuation of the speed control, the pressure plate is forced substantially downward until it contacts at least one in-line wheel. Actuation of the speed control can be accomplished using either a lever, or alternatively, by a cable actuating means.

Further included in the frame portion of the present invention are means for quickly releasing and replacing the in-line wheels, such as when worn or damaged.

The present invention departs from the teachings of the prior art by forming a substantial part of the upper shoe portion of soft, pliable, breatheable materials capable of transmitting air and heat directly therethrough, while also properly

supporting the user's foot. The support is provided in a few critical areas, such as the ankle and heel of the user's foot, using rigid materials. Semirigid materials may also be used in some support portions. In particular, the upper shoe portion of the present invention comprises a soft, pliable, breatheable shoe material in combination with a rigid or semirigid base portion and ankle support cuff. As a result, the body of the upper shoe portion is comfortable for a skater to wear while the base portion and ankle support cuff of the upper shoe portion provide the support needed to allow a skater to easily maintain the in-line roller skate wheels oriented vertically on their roller surfaces while skating.

The term "rigid" with respect to the present invention means a plastic material highly resistant to bending or flexing, while "semirigid" means that the material, while capable of resisting a substantial deforming force, is also able to bend or be temporarily deformed by a force somewhat greater than the normal force encountered in use. "Heat-moldable" refers to both rigid and semirigid plastic materials that become reasonably pliable and formable at a higher temperature than would customarily be associated with in-line roller skating.

In general, heat-moldable "rigid" and "semirigid" plastic materials are used in combination with soft, pliable breatheable materials, in an in-line roller skate, to provide greater comfort, without forgoing the support that has previously been achieved using "rigid" materials. It will be understood that the terms "rigid" and "semirigid" may thus refer not only to the type or hardness of material used in the in-line roller skate, but also to the thickness of the material. Similarly, the terms "nonrigid," "soft," and "pliable" describe materials such as leather, cloth, or mesh fabrics of various densities that have a certain flexibility and "give" to them as compared to a rigid or semirigid material and, thus, are more comfortable for a skater when placed adjacent a skater's foot. The term "breatheable" refers to a material through which air can readily pass and is distinguished from molded plastic materials of either the rigid or semirigid type that are substantially impervious to air transmission or which simply provide ventilation ports for air circulation.

Other aspects of the present invention include attachment means for attaching the base portion of the in-line roller skate to the lower frame. The attachment means compensates for lateral and longitudinal adjustment of the boot upper with respect to the lower frame and includes pegs and hooks to properly align the boot upper and the lower frame during assembly. Alternatively, the base portion and lower frame may be a single molded unit.

As an alternate embodiment of the invention, the skate includes a base having first and second longitudinal slots and first and second base fasteners. The first base fastener is slidable within the first longitudinal slot and the second base fastener is slidable within the second longitudinal slot. The frame has first and second transverse slots and first and second frame fasteners slidably engaged within the first and second transverse slots, respectively. The first and second frame fasteners are engaged with the first and second base fasteners, respectively.

Preferably, the first and second longitudinal slots of this alternate embodiment each include a narrow slot portion and a wide slot portion having a greater width than the narrow slot portion. The narrow slot portion is centered below the wide slot portion. The first and second base fasteners include head portions that are nonrotatably engaged within the wide slot portions of the first and second longitudinal slots, respectively.

Brief Description of the Drawings

The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a perspective view of one embodiment of the present invention, illustrating the soft, pliable, breatheable shoe portion and semirigid ankle support cuff attached to the lower frame portion of the present invention;

FIGURE 2A is a perspective view of one embodiment of the footbed portion of the present invention, illustrating the lip supports and the heel counter;

FIGURE 2B is a perspective view of another embodiment of the footbed portion of the present invention, illustrating a modified toe portion;

FIGURE 3A is a sectional side view of the footbed portion of FIGURE 2A of the present invention, including the heel counter, raised support lips, and the frame mounting means;

FIGURE 3B is a sectional side view of the footbed portion of FIGURE 3A of the present invention, including the heel counter, toe portion, and frame mounting means;

FIGURE 4 is a side elevational view of the present invention, illustrating the ankle support cuff, the ankle support cuff canting means in section, and alternate longitudinal canting positions of the ankle support cuff;

FIGURE 5 is a rear elevational view of the present invention, illustrating the ankle support cuff and ankle support cuff adjustment means, in section, and alternative lateral canting positions of the ankle support cuff;

FIGURE 6 is a side sectional view of the ankle support cuff adjustment means;

FIGURE 7 is a diagrammatic plan view of the ankle support cuff adjustment means;

FIGURE 8 is a diagrammatic side elevational view of the lower frame portion of the present invention, including a speed control means;

FIGURES 9 and 10 are diagrammatic partial side sectional views illustrating a speed control means made in accordance with the present invention and showing the speed control means in its nonbraking and braking modes, respectively;

FIGURES 11 and 12 are diagrammatic partial side sectional views of a second embodiment of the speed control means of the present invention, illustrating a cable actuating means for the speed control;

FIGURE 13 is an exploded perspective view of the lower frame portion of one embodiment of the present invention;

FIGURE 14 is a diagrammatic side elevational view of an alternative embodiment of the speed control means of the present invention, wherein braking is applied to three of the four in-line wheels of the in-line roller skate;

FIGURE 15 is a diagrammatic side elevation view of still another alternate embodiment of the speed control means of the present invention, wherein braking is applied to all of the in-line wheels of an in-line roller skate;

FIGURE 16A is a front perspective view of one embodiment of the present invention, illustrating the soft, pliable, breatheable shoe portion, an external lace cover, and the semirigid ankle support cuff and securing strap attached to a lower frame portion;

FIGURE 16B is a partial perspective view of the present invention illustrating an alternative embodiment having the footbed portion and lower frame portion combined as a single injection-molded unit;

FIGURE 17 is a sectional rear view of the upper shoe portion, showing the heel counter and ankle support cuff;

FIGURE 18 is a perspective view of an alternate preferred embodiment of the in-line skate of the present invention, illustrating both a brake and a second strap;

FIGURE 19 is a perspective view of one embodiment of a means for attaching the base of the skate to the frame;

FIGURE 20 is a perspective view of a base/frame position adjustment structure of the present invention;

FIGURE 21 is a partially exploded perspective view of the structure of FIGURE 20;

FIGURE 22 is a sectional view of a portion of the structure illustrated in FIGURE 20;

FIGURE 23 is a bottom view of the base illustrated in FIGURE 20;

FIGURE 24 is a perspective view of an alternate boot of the present invention;

FIGURE 25 is a side view of the boot illustrated in FIGURE 24 and including the frame and wheels;

FIGURE 26 is a perspective view of another alternate embodiment of a boot according to the invention;

FIGURE 27 is a sectional view of a portion of the boot illustrated in FIGURE 26; and

FIGURE 28 is a perspective view of the boot of FIGURE 26 with the soft portion of the upper removed.

Detailed Description of the Preferred Embodiment

Referring to FIGURE 1, an in-line roller skate 21 made according to the present invention is disclosed. The in-line roller skate 21 includes a soft, pliable, breatheable shoe portion 22, which is preferably made of breatheable materials of the type commonly used in running shoes. Leather or leather-like man-made materials may be used, as may cloth fabrics and mesh fabric materials. Since the principal physical support for the skater's foot in the present invention is provided by strategically positioned support members, including an exterior ankle support cuff 23 and a base portion 39 to be described hereafter, the materials used to construct the shoe portion 22 are chosen for comfort, breathability, and heat transmissibility to cool the skater's foot. For purposes of describing the present invention, the shoe portion 22, the base portion 39, and the ankle support cuff 23 together form what is referred to as the entire upper shoe portion.

The in-line roller skate 21 of the present invention includes a base portion 39, a heel counter 41, a soft, pliable, breatheable shoe portion 22, which in one embodiment includes a rigid or semirigid toe portion 24, and an ankle support cuff 23 having a conventional securing strap 26. While the preferred embodiments will be discussed in detail below, it is understood that the shoe portion 22 may integrally include both the toe portion 24 and the heel counter 41. The heel counter 41 and/or the toe portion 24 may be laminated externally of the shoe portion 22 or be integrally

contained within the shoe portion 22. Alternatively, the heel counter 41 and/or the toe portion 24 may both be an integral part of the base portion 39 or one or the other may be attached to the base portion 39 while the other is attached to the shoe portion 22. The material comprising the heel counter 41 and the toe portion 24 may be rigid or semirigid materials, depending on the intended use of the in-line roller skate 21 and the desired degree of support.

In-line roller skate 21 further includes an external ankle support cuff 23 having a conventional securing strap 26. The ankle support cuff 23 is shown hingedly mounted on the heel counter 41. Although it will be understood that the ankle support cuff 23, which is made of either rigid or semirigid material, can likewise be an integral part of the soft, pliable, breatheable shoe portion 22, the preferred embodiment of the present invention mounts the ankle support cuff 23 internally and hingedly to the heel counter 41. The ankle support cuff 23 can, alternatively, be externally mounted to the heel counter 41. It will also be understood that heel counter 41 can itself be an integral part of the soft boot or an external counter bonded to the soft boot. The ankle support cuff 23 can include both longitudinal canting means 25 and lateral canting means 27, which will be described in detail hereinafter.

FIGURE 1 discloses an external lace cover 29, which may be integrally connected to the soft, pliable, breatheable shoe portion 22 at its base 26 so that the lace cover can be pivoted forwardly to allow easy access to the shoe laces and the interior of the shoe. Referring also to FIGURE 16A, conventional shoelaces 28 may be provided inward of the lace cover 29. Internal tongue 29a is provided to prevent the laces 28 from bearing directly on the skater's foot.

Also illustrated in FIGURE 1 is a lower frame portion 31 that is typically formed of injection-molded plastic or metal and a speed control 33, which will be described in detail hereinafter. The lower frame portion 31 may alternatively be made of fiberglass with an epoxy resin or graphite with an epoxy resin. A plurality of in-line wheels 35 are mounted on axle means 36, which will also be described in detail hereinafter. The in-line wheels 35 are mounted for rotation in a common longitudinal plane. Axle means 36 are shown fitted in upwardly extending notches 37 in lower frame portion 31 in a manner such that wheels 35 can be easily replaced or interchanged when worn. While the notches 37 are shown for purposes of describing the present invention, it will be understood that a variety of methods of mounting the in-line wheels 35 can be used, including mounting methods that allow variation in the vertical positioning of the axes of rotation of the in-line wheels 35.

FIGURES 2A and 3A illustrate the base portion 39 made in accordance with the present invention. The base portion 39 can be a relatively simple flat sole or a relatively complex contoured sole containing supports and attachment means. For purposes of the present description, the base portion 39 will be described in its more complex form, it being understood that not all of the supports or attachments described hereinafter need be included in every embodiment of the present invention. Referring to FIGURES 2A and 3A, the base portion 39 includes a sole portion 40, an integrally connected heel counter 41 for cupping the back of the skater's heel, and raised support lip 43 on the sides of the base portion 39 in the area of the ball of the skater's foot. In a preferred embodiment, the sole portion 40 has an upper surface and a lower surface. The upper portion of the sole portion 40 may be anatomically fitted to the user's foot by molding or other known techniques as described hereinafter, to evenly distribute pressure along the bottom of the foot. The heel counter 41, and the raised support lips 43 provide support to aid the skater in maintaining the in-line roller skate in a substantially vertical position. The lower portion of the sole portion 40 provides an interface for mounting the upper shoe portion onto the lower frame portion where the upper shoe portion and the lower frame portion are separate units. Because in this invention much of the upper shoe portion is formed of soft, pliable, breatheable material, the footbed portion, and other supports, including primarily the ankle support cuff 23, provide substantially all of the needed support and stability for the skater's foot.

The sole portion 40 of the base portion 39 may include an arch support portion 45, a heel support 47, and a ball support 49. The supports 45, 47, and 49 contour the base portion 39 to the user's foot and are preferably made of a heat-moldable plastic integrally mounted in the sole portion 40 of the footbed portion 39. The use of heat-moldable plastic enables a skater to heat the moldable plastic supports 45, 47, and 49 by conventional means, such as a hair dryer, to a temperature sufficient to cause them to become pliable. The footbed portion 39 can then be anatomically fitted to the skater's foot by placing the foot therein and allowing the heat-moldable plastic to cool and harden in a shape conforming to the skater's foot. The plastic supports 45, 47, and 49 may be included as desired or required depending on skate design criteria and the form of the mounting means contained within the base portion 39.

The heel counter 41 and the raised support lips 43 may also be fabricated from heat-moldable plastics. As with the supports 45, 47, and 49, the heel counter 41 and the raised support lip 43 can be anatomically fitted to the user's foot using a

conventional hot air heat source. The base portion 39 of the present invention can thus be formed to fit the user's foot, thereby minimizing unwanted movement of the skater's foot within the upper shoe portion, while simultaneously improving the overall comfort of the upper shoe portion.

While FIGURES 2A and 3A show the heel counter 41 as an integral part of the base portion 39, other embodiments of the present invention may integrally mount the heel counter 41 in the soft shoe portion 22, while the base portion 39 would primarily comprise sole portion 40. Alternatively, the base portion 39 could contain an additional heel counter portion such that the shoe portion 22, and the integral heel counter 41, are laminated thereto in a known fashion.

Again referring to FIGURES 2A and 3A, the sole portion 40 of base portion 39 is shown to include a pair of front mounting means 51a and at least one identical rear mounting means 51b. Mounting means 51a and 51b are adapted to allow the upper shoe portion to be mounted to the lower frame portion 31 in a manner such that the upper shoe portion may be moved both laterally and longitudinally with respect to lower frame 31 as desired by the user. In particular, mounting means 51a and 51b each include a plate 53 having a threaded opening 54a formed therein and adapted to receive a complementary threaded fastener such as 54b (FIGURE 3A), which is sized to extend upwardly through a portion of the lower frame portion 31. Each plate 53 is mounted in an oversized cavity 54c formed in the sole portion 40, such that the plate 53 can move both laterally and longitudinally within the cavity 54c when the fastener 54b is loosened in the threaded opening 54a. When the skater adjusts the position of the upper shoe portion to its desired location with respect to the lower frame portion 31, the fasteners 54b are tightened to hold the upper shoe portion in position. While it is preferred that the upper shoe portion be both laterally and longitudinally adjustable with respect to the lower frame portion 31, it will be understood that the base portion 39 can be permanently fastened to the lower frame portion 31 using conventional fastening means, such as rivets. In addition, the base portion 39 and the lower frame portion 31 can be integrally combined in a single injection-molded unit such as shown in FIGURE 16B. This embodiment does not allow adjustment of the upper shoe portion with respect to the lower frame portion 31, but does provide substantial desired rigidity and strength between the upper shoe portion and the lower frame portion 31.

Referring to FIGURES 2B and 3B, an alternate form of base portion 39a of the present invention is disclosed, without the raised support lips 43, but including a toe portion 24. In this embodiment, the soft, pliable, breatheable shoe portion 22 may

be laminated to the base portion 39 such that toe portion 24 provides additional laminating surface, adding support and strength to the shoe portion 22. In addition, the toe portion 24 can be extended rearward sufficiently to provide the earlier described support function of lips 43. The durable, semirigid toe portion 24 further protects the soft pliable material comprising the shoe portion 22 from damage caused by scuffing the toe, or by the toe of the in-line roller skate 21 bumping or scraping the road surface or other objects.

FIGURES 4 and 5 illustrate an ankle support cuff 23 made according to the present invention. The ankle support cuff 23 is secured to the heel counter 41 through lateral support apertures 55 and longitudinal support aperture 56 (shown in FIGURES 2A and 2B) in a manner to be described hereinafter. In one embodiment, the ankle support cuff 23 can be rigidly fixed to the heel counter 41, allowing very limited flex of the ankle support cuff 23 with respect to the footbed portion 39 and the lower frame portion 31. In this mode, the in-line roller skate becomes a substantially rigid unit with no longitudinal or lateral adjustment and flexibility is limited to that produced by the flex of the materials comprising the ankle support cuff 23, the heel counter 41, and base portion 39. As a means of controlling flexibility, the material used in the fabrication of the ankle support cuff 23 can be selected for its characteristic flexibility, which may range from very rigid to a pliable, but semirigid material.

In an alternative embodiment, ankle support cuff 23 can be hingedly attached to the heel counter 41 through lateral support apertures 55, thus allowing forward and rearward pivotal movement of the ankle support cuff 23. As discussed earlier, the heel counter 41 can either be an integral part of the base portion 39 or of the shoe portion 22. Hinging of the cuff allows the skater to flex his ankle forward and rearward with ease, while providing considerable rigidity in the lateral direction. In still another embodiment of the present invention, the ankle support cuff 23 is adjustable both longitudinally (FIGURE 4) and laterally (FIGURE 5) as described more fully hereinafter.

The ankle support cuff 23, in combination with the base portion 39 and the heel counter 41, supports the skater's ankle and foot and assists the skater in maintaining a substantially upright ankle position. The ankle support cuff 23 is preferably made of a semirigid plastic and may be made of a heat-moldable plastic similar to the heat-moldable plastics described above with respect to the footbed supports 45, 47, and 49. As with the heat-moldable plastics in the base portion 39,

the heat-moldable plastic ankle support cuff 23 can also be heated with hot air and formed for a better fit.

In-line roller skating requires substantial shoe support in combination with the strength, coordination, and agility of the skater to maintain the in-line roller skate in a near vertical position. The various support components of the present invention described heretofore, including the ankle support cuff 23, the heel counter 41, and the base portion 39, provide the needed support, thus allowing soft, pliable, breatheable shoe portion 22 to be made of material such as leather, mesh fabric, or the like, to enhance the comfort of the in-line roller skate. It will be understood that any of the known materials commonly used in running shoes to provide comfort and to dissipate heat by allowing air circulation about the user's foot can be used in the present invention to accomplish the goal of providing a comfortable, cool, in-line roller skate whose principal foot support comes from strategically placed support structures rather than from a rigid molded boot.

The ankle support cuff 23 of the present invention may include a canting system for lateral and longitudinal tilt adjustments. In general, the preferred embodiment of the canting system comprises two movable parts, each respectively associated with either the ankle support cuff 23 or the heel counter 41 and capable of being securely locked together. As will be described hereafter, a skater wishing to tilt the ankle support cuff longitudinally or laterally loosens the longitudinal canting means 25 or the lateral canting means 27 and moves the two parts with respect to one another to position the ankle support cuff 23 according to the skater's preference. It will be readily apparent to those skilled in the art that the lateral canting means 27 can be placed on either the inside or the outside of the ankle-supporting cuff 23. Phantom views in FIGURE 4 show the support cuff 23 adjusted to various longitudinally canted positions, while in FIGURE 5, the phantom views show the ankle support cuff 23 adjusted to various laterally canted positions as desired by the skater.

As can be seen from FIGURES 1 and 16A, the soft, pliable, breatheable shoe portion 22 substantially surrounds the skater's foot and extends above the ankle support cuff 23. The extension of the shoe portion 22 above the ankle support cuff 23 prevents the upper portion of the semirigid ankle support cuff 23 from uncomfortably binding against the skater's ankle or calf. In a similar fashion, the internal tongue 29a also extends above the ankle support cuff 23 to prevent the ankle support cuff 23 from binding against the skater's shin when substantial longitudinal forward force is applied against the ankle support cuff 23 and securing strap 26.

Referring now to FIGURES 6 and 7, the longitudinal and lateral canting mechanisms of the present invention are disclosed in detail. In a preferred embodiment, the canting mechanism includes a cap nut 101 mounted to or within the heel counter 41 such that its internally threaded barrel 103 extends into a slot 117 in the heel counter 41. The outer surface of the heel counter 41 in the region adjacent the slot 117 includes a plurality of surface grooves 109 arranged on opposite sides of the slot, so that the grooves on one side of the slot are angled relative to those on the opposite side in a chevron-like configuration. The ankle support cuff 23 includes an opening 104 outwardly adjacent the internally threaded barrel 103 into which is inserted a plug 111 having surface grooves 113 sized and configured to engage the surface grooves 109. The plug 111 includes a central opening 112 into which is inserted a cap screw 114 threaded to engage the internally threaded barrel 103 of the cap nut 101. It will be understood that tightening of the cap screw 114 relative to the cap nut 101 causes the cooperating grooves 109 and 113 on the heel counter 41 and the plug 111, respectively, to engage each other, to fix the position of the ankle support cuff 23 with respect to the base portion 39. When the cap screw 114 is loosened, the grooves 109 and 113 can be disengaged, and the cap nut 101 can be moved within the slot 117 to allow the ankle support cuff 23 to be canted relative to the base portion 39.

Referring now to FIGURE 8, one embodiment of the lower frame portion 31 of the present invention is disclosed. The lower frame portion 31 comprises a frame rail 57b, which preferably includes notches 37 (shown in FIGURE 1) in which the axle means 36 are held to allow in-line wheels 35 to be easily interchanged or replaced. While the notches 37 are shown for purposes of describing the present invention, it will be understood that a variety of methods for mounting the in-line wheels 35 can be used, including mounting methods that allow vertical adjustments of the axis of rotation of the plurality of in-line wheels 35. The in-line wheels 35 are mounted to be rotatable in a common longitudinal plane of rotation. The lower frame portion 31 further includes a brake or speed control 33 having an actuating lever 59. In use, a skater reaches down and pulls upward on the actuating lever 59 forcing contoured speed control plate 61 to bear against the in-line wheels 35. Alternatively, those skilled in the art will recognize that the actuating lever 59 may be arranged and configured such that, in use, speed control plate 61 bears against the in-line wheels 35 by pushing down on actuating lever 59. This mechanism is discussed in further detail hereafter. In a preferred embodiment of the present invention, the contoured speed control plate 61 contacts a minimum of two wheels, typically the two rearmost wheels

on the in-line roller skate. However, those skilled in the art will readily recognize that the contoured speed control plate 61 may contact from as few as one in-line wheel 35 to as many as all of the in-line wheels 35 mounted on the lower frame portion 31.

FIGURES 9 and 10 show the speed control means 33 of FIGURE 8 in longitudinal cross section in its unactuated and actuated or braking positions, respectively. The contoured speed control plate 61 is movable on a vertical shaft 62 in a substantially vertical direction, toward and away from the in-line wheels 35. A biasing spring 63 acts to bias the contoured speed control plate 61 away from the in-line wheels 35. When a force overriding the biasing spring 63 is applied to the actuating lever 59, the contoured speed control plate 61 moves in a downward direction to contact the in-line wheels 35. Contact between the speed control plate 61 and the in-line wheels 35 creates friction sufficient to impose a drag on the in-line wheels 35, thus slowing or stopping the rotation of the wheels, thereby controlling the speed of the skater. Varying the force applied to the actuating lever 59 varies the drag on the in-line wheels 35. It will be understood that application of a selected force will slow but not necessarily stop the in-line wheels 35 so that the skater's speed can be controlled, such as when descending a grade. The contoured speed control plate 61 can be made of any suitable material, including plastic or a metal such as aluminum.

Referring now to FIGURE 13, there is shown an exploded view of the lower frame portion 31 of the present invention, including the speed control 33. The contoured speed control plate 61 is shown positioned between an upper mounting bracket 65 and a lower mounting bracket 67. The mounting brackets 65 and 67 are securely attached between frame rails 57a and 57b using appropriate fastening means, such as machine screws 69. The contoured speed control plate 61 is movable in a substantially vertical direction within the mounting brackets 65 and 67, from an uppermost position, such as that shown in FIGURES 9 and 11, to a lowermost position wherein the contoured speed control plate 61 contacts the in-line wheels 35, as shown in FIGURES 10 and 12.

The actuating lever 59 is mounted to pivot about a fulcrum pin 73, which is in turn mounted between the frame rails 57a and 57b by means of a fastener 69, and is attached at its inner end to a pressure plate 71. Accordingly, when the actuating lever 59 is raised, pressure is applied to the pressure plate 71 in a downward direction. The pressure plate 71, being directly connected to the contoured speed control plate 61, causes the contoured speed control plate 61 to move in a downward direction toward the lower mounting bracket 67. This downward movement results in

contact of the contoured speed control plate 61 with the in-line wheels 35. The downward motion of the contoured speed control plate 61 is limited first, and preferably, by its contact with the in-line wheels 35. However, if the contoured speed control plate 61 continues to move in a downward direction, the biasing spring 63 will eventually become fully collapsed before the pressure plate 71 contacts the upper mounting bracket 65, and before a lower portion 66 of the contoured speed control plate 61 contacts the lower mounting bracket 67.

FIGURES 11 and 12 show a second embodiment of the present invention wherein the actuating lever 59 is replaced with a cable 75. The biasing spring 63 again biases the contoured speed control plate 61 away from in-line wheels 35. When the cable 75 is pulled in an upward direction, a cable pressure housing 77 applies a downward force against the pressure plate 71, forcing the contoured speed control plate 61 to move in a downward direction toward the in-line wheels 35. In this embodiment of the present invention, the cable 75 uses as its anchoring member, the lower mounting bracket 67. Shortening of the cable 75 causes the distance between the pressure plate 71 and the lower mounting plate 67 to be reduced, thereby forcing the contoured speed control plate 61 downwardly. As with the earlier described embodiment of FIGURES 9 and 10, the cable 75 can apply force to the in-line wheels 35 as needed to control the speed of or bring the in-line wheels 35 to a stop. It will be understood that the cable 75 can run upward to the area of the skater's knee or belt where it can be easily grasped, or held in the skater's hands so that the skater can continuously apply speed control pressure as needed. A conventional handgrip can be attached to the cable to allow it to be more easily held and pressure applied by the skater. Alternatively, a cable or similar actuating means could be attached to the actuating lever 59 (in FIGURES 8- 10), so that the skater could pull up on the cable to cause the end of actuating lever 59 to move upward, forcing the contoured speed control plate 61 against the in-line wheels 35.

FIGURE 13 shows a conventional system for mounting the in-line wheels 35 within the frame rails 57a and 57b. In particular, an in-line wheel 35 is mounted on a bearing hub 35a having a central opening. The axle 36, which comprises an internally threaded cap nut 36a and a cooperating threaded cap screw 36b, extends through the frame rails 57a and 57b, spacer washers 36c and 36d on opposite sides of the in-line wheel 35, and through the opening in the bearing hub 35a. The internally threaded cap nut 36a and the cooperatingly threaded screw 36b are sized such that, when the screw is fully threaded into the nut, an axle of uniform diameter is provided on which

the in-line wheel 35 can rotate. The caps of the screw and nut grip the outer surfaces of the frame rails adjacent frame notches 37.

Referring now to FIGURES 14 and 15, the contour speed control plate 61 of the present invention is shown shaped to apply drag to more than two of the in-line wheels 35. FIGURE 14 shows an embodiment of a contoured speed control plate 61a, as applied to three in-line wheels 35, and FIGURE 15 shows an embodiment wherein the contour speed control plate 61 is applied to four in-line wheels 35. Accordingly, a skater using the actuating lever 59 can apply force to the in-line wheels 35, in the manner heretofore described, as needed to control the speed or stop the in-line wheels 35. Alternatively, a cable such as 75 can be used to apply drag force to the contoured speed control plates 61a or 61b. It will be readily apparent to those skilled in the art that, with appropriate modification of the mounting structure, the contoured speed control plate 61 can be applied to as many wheels as desired for adequate speed control. While not illustrated, it is also possible and considered to be within the scope of this invention, using either the actuating lever, or the cable of the present invention to have more than one speed control 33 applying downward pressure to a single contour speed control plate 61, or multiple contoured speed control plates, in more than one position along the frame rails 57a and 57b.

The preferred embodiment of the present invention, wherein the contoured speed control plate 61 is housed substantially above the in-line wheels 35 and securely maintained between the frame rails 57a and 57b, has advantages over the prior art in that the speed control 33 is substantially removed from debris including rocks, dirt, grass, et cetera, which could become entangled in a speed control positioned lower on the frame rails 57a and 57b. In addition, by maintaining the speed control 33 substantially between the frame rails 57a and 57b, the present invention protects the components of the speed control from damage due to the lower frame portion 31 contacting rigid objects or being carelessly handled.

Referring to FIGURE 16A, there is shown a perspective view of an embodiment of the present invention with the soft, pliable, breatheable shoe portion 22 laminated in place on the base portion 39a, as described above with respect to FIGURES 2B and 3B.

As discussed heretofore, FIGURE 16B discloses the base portion 39 having a frame portion 31 molded integrally therewith. A soft upper shoe portion may be laminated therein in a known fashion, such as by applying glue along the base and lower sides of the shoe in the area of the heel and toe supports and then curing.

While there are manufacturing cost advantages in having the upper shoe portion separable from the lower frame portion 31, it is also desirable in some skate designs for the base portion 39 to be both laterally and longitudinally adjustable with respect to the lower frame portion. It is also advantageous to have the base portion 39 molded integrally with the lower frame portion 31. More specifically, certain rigidity improvements can be obtained by eliminating the interface between the base portion 39 and the lower frame portion 31, and eliminating the fastening means used to securely hold the two components together.

Referring now to FIGURE 17, there is shown a rear sectional view of the embodiment of FIGURE 16A of the present invention showing an ankle support cuff 23, a soft, pliable, breatheable shoe portion 22, a lateral canting means 27 and an external heel counter 41. As discussed heretofore, adhesive may be applied at interface 48 to bond the shoe portion 22 to the heel counter 41 and the base portion 39.

Referring to FIGURE 18, an alternate preferred embodiment of the present invention will now be described. As with the embodiments described above, the in-line roller skate boot 221 includes a boot upper 220 having a soft, pliable, breatheable portion 222, which is preferably made of breatheable materials such as ballistic nylon mesh. The breatheable portion 222, the base portion 239, and the ankle support cuff 223 together form what is referred to in this description as the boot upper 220.

The in-line roller skate boot 221 also includes a base portion 239, a heel counter 241, and a rigid or semirigid toe portion 224. Ankle support cuff 223 has both a conventional securing strap 226 and a second strap 228. The breatheable portion 222 may integrally include the toe portion 224, the heel counter 241 and/or the ankle support cuff 223, or the toe portion, heel counter and/or ankle support cuff may be laminated or fastened externally of the breatheable portion 222.

Other details not described in detail below are as described above with reference to FIGURES 1-17.

FIGURE 18 also discloses an external lace cover 229 and a securing strap 232. The external lace cover 229 is preferably integrally connected to the soft, pliable, breatheable portion 222 at its base 230 so that the lace cover 229 can be pivoted forward to allow easy access to the shoelaces and the interior of the shoe. The securing strap 232 secures that portion of the breatheable portion 222, which extends above the exterior ankle support cuff 223.

The substantially nonelastic but flexible strap 228 diagonally crosses the instep of the skater's foot. The strap 228 is preferably secured to the base portion 239 of the

in-line roller skate boot using slots 234, which are disposed on opposite sides of the in-line roller skate boot, preferably in the heel counter 241. The strap 228 includes two parts, each of which is threaded through one of the slots 234 and secured to the other using a Velcro hook-and-loop fastening material 320. The strap 228 may also be riveted or screwed to the heel counter 241 using appropriate fasteners and may have an appropriate buckle or ratchet mechanism for securing the two parts of the strap together over the skater's instep under tension or for securing a single strap to either side of the heel counter 241 under tension.

Referring now to FIGURE 19, there is shown the base portion 239 and a first embodiment of the means for attaching the boot upper 220 to the lower frame 235. To align the lower frame 235 on the base portion 239, the heel of the preferred embodiment includes a general L-shaped hook 237 that extends downwardly from the bottom of the heel and rearwardly toward the rear of the heel. The base portion 239 includes a generally cylindrical peg 238 or other protrusion that extends downwardly from the bottom of the base portion 239. Both the peg 238 and the hook 237 are located along a central axis 240 extending over the length of the boot.

Although the preferred embodiment includes a peg 238 and a hook 237, alternate embodiments (not shown) could include two pegs, two hooks, or other protrusions extending downwardly from the base portion 239. In still other alternative embodiments (not shown), the base portion could include indentations or holes adapted to receive pegs or hooks extending upwardly from the lower frame. As yet another alternative embodiment, the lower frame 235 could include a front and rear bracket (not shown), wherein frame rails of the lower frame could be adapted to be securely fastened to the boot upper 220.

The use of peg 238 and hook 237 on the base portion 239 of the in-line roller skate boot ensures that the upper boot portion 233 is properly aligned upon placement of the boot upper 220 onto the lower frame 235. The configuration also allows separate brackets to be formed and attached to the base portion 239, so that different lower frames can be interchangeably mated with different boot upper designs. Boot upper designs may be altered in any manner desired without altering the removable bracket or lower frame design, as long as the contour of the base portion 239 remains substantially fixed. Thus, lower frames bearing links and dimensions, including options such as rockering, wheel brakes, and differing numbers or sizes of wheels, can be used with the same boot. In other words, different running assemblies can be used with the same boot, as long as the base portion and brackets are suitably configured.

Referring now to FIGURE 20, there is shown a second embodiment of the boot upper 220 mounted onto the lower frame 235. As will be described below, lower frame 235 is adjustable relative to boot upper 220. The boot upper 220 preferably includes a breatheable portion 222 and a base portion 239. Base portion 239 is preferably constructed of a polymeric material with fiber reinforcement.

Lower frame 235 includes frame rails 242L and 242R, wheels 244, and forward and rearward brackets 246 and 248. Rails 242L and 242R are preferably constructed of a graphite composite. Rails 242R and 242L lie in parallel vertical planes that are perpendicular to base portion 239 of boot upper 220. Preferably, rails 242L and 242R are adapted to secure five wheels 244 lying in an intermediate vertical plane between rails 242L and 242R, although a lesser or greater number of wheels can be used. Rails 242L and 242R are connected to forward and rearward brackets (246 and 248) with rail fasteners 249. For example, left rail 242L is secured to forward bracket 224 with two rail fasteners 249 extending through holes bored just below the upper edge of rail 242L. Other numbers of fasteners could alternatively be used. Rail fasteners 249 can also be any standard fastener that adequately secures rails 242L and 242R to brackets 246 and 248. As another alternative, rails 242L and 242R and brackets 246 and 248 can be one piece, such that rail fasteners 249 are not needed. The specific configuration of rails 242L and 242R in brackets 246 and 248 could also be varied as long as the primary purpose of providing an adjustable mounting to base portion 239 is served.

Brackets 246 and 248 have upside-down U-shaped cross sections. The top portions of brackets 246 and 248 lie in horizontal planes parallel to portions of base portion 239. Each of brackets 246 and 248 has a bracket slot 251 running in a longitudinal direction or, in other words, parallel to rails 242L and 242R. Bracket slots 251 allow for longitudinal adjustment of lower frame 235 relative to base portion 239.

Base portion 239 also includes forward and rearward base slots 253 and 255. Base slots 253 and 255 extend generally perpendicular to bracket slots 251. Forward base slot 253 is formed by forward ridge 257 that extends across almost the entire width of base portion 239 beneath the portion of the boot upper 220 that holds the ball of the foot above base portion 239. The forward ridge 257 projects below the remainder of base portion 239 such that no interference with forward bracket 246 is allowed, other than with forward ridge 257. Forward ridge 257 has an elongated oval shape, with rounded ends in a flat bottom surface parallel to the upper portion of forward bracket 246. A rear ridge 259 is disposed under the heel of the foot of the

skater and projects downwardly from base portion 239. Rear ridge 259 is similar in shape and function to forward ridge 257 and forms rear base slot 255. Rear ridge 259 is not as wide as forward ridge 257, since that portion of the base is narrower. Rear base slot 255 is parallel to forward base slot 253. The length of forward and rearward base slots 253 and 255 can be changed, as can their transverse orientation. Rearward base slot 255 can even be extended such that greater rearward adjustment is allowed, compared to forward adjustment. In the preferred embodiment, the horizontal plane of the bottom surface of rearward ridge 259 is spaced farther above wheels 244 than is the horizontal plane of the bottom surface of forward ridge 257.

Base support ribs 261 are also illustrated in FIGURE 20. Base support ribs 261 provide structural support between rearward ridge 259 and forward ridge 257 and in front of forward ridge 257. Because of the unique cross-ribbed structure of base support ribs 261, torsional, longitudinal, and lateral support is provided for base portion 239, while weight is reduced. Base support ribs 261 will be discussed in more detail in connection with FIGURE 23.

Referring now to FIGURES 21 and 22, the assembly of the in-line roller skate boot 221 will be discussed. Lower frame 235 is attached to base portion 239 with frame fasteners 263 and base fasteners 265. Frame fasteners 263 are screws with fastener shoulders 267 and threaded shafts 269. Two such frame fasteners 263 are preferably used, one for forward bracket 246 and one for rearward bracket 248. Fastener shoulders 267 are disposed adjacent the heads of frame fasteners 263. The diameter of fastener shoulders 267 is only slightly smaller than the width of bracket slots 251, as fastener shoulders 267 are engaged within slots 251 when in use. Threaded shafts 269 project upwardly from fastener shoulders 267 to threadably engage base fasteners 265. Base fasteners 265 include heads 271 and threaded sleeves 273. Threaded shafts 269 threadably engage the threaded bores of sleeves 273. Two base fasteners 265 are used in the preferred embodiment illustrated in FIGURE 21, one in each of base slots 275 and 277. Heads 271 of base fasteners 265 are disposed at the upper ends of sleeves 273. Heads 271 are oriented in horizontal planes within slots 275 and 277, while sleeves 273 are generally perpendicular to heads 271. Heads 271 have flat surfaces on the forward and rearward sides such that they do not rotate, yet slidably engage slots 275 and 277.

As mentioned above, slots 275 and 277 are similar, except for the length of slots 275 and 277, forward slot 275 generally being longer than rearward slot 277. Slots 275 and 277 have slotted plates 279 molded within them. Slotted plates 279 are preferably constructed of aluminum, although other materials of comparable strength,

preferably of light weight, may alternatively be used. This construction provides for decreased wear and resistance to deformation upon the tightening of fasteners 263 and 265. Slotted plate 279 is nested between a narrow slot portion 281 and a wide slot portion 283. The outside perimeters of slotted plates 279 are within the outside perimeters of ridges 257 and 259. Narrow slot portion 281 is disposed beneath slotted plate 279 and has a bottom rim defined by ridges 257 and 259 of forward and rearward base slots 253 and 255, respectively. The width of narrow slot portion 281 is slightly larger than the diameter of sleeve 273 of base fastener 265. The narrowest portion of head 271 is that portion between the flat surfaces on the forward and rearward sides of head 271. The width of wide slot portions 283 is narrower than the widest width or diameter of head 271. This arrangement provides for a nonrotatable engagement of head 271 within wide slot portions 283. The bottom surface of head 251 rides upon slotted plate 279.

A slot shoulder 285 is formed around the top of the perimeter of wide slot portion 283. Forward and rearward slot covers 287 and 289 are provided to fit over forward and rearward base slots 257 and 259 upon slot shoulders 285. Thus, the shape of forward and rearward slot covers 287 and 289 matches the outer shape of slot shoulder 285, i.e., they have an oblong, oval shape. The thickness of forward and rearward slot covers 287 and 289 is such that a generally smooth-topped surface of base portion 239 is presented when forward and rearward slot covers 287 and 289 are in place. The thickness of wide slot portion 283 is slightly greater than the thickness of heads 271 of base fasteners 265 such that base fasteners 265 are free to slide back and forth within forward and rearward base slots 251 and 253 when not tightened to frame fasteners 263.

With the above construction in an assembled configuration, as illustrated in FIGURE 22, base slots 275 and 277 are disposed directly above and transverse to the longitudinal axis of bracket slots 251. This arrangement allows for a wide range of longitudinal or lateral adjustments or a combination of both, depending on the preferences of the individual skater. Adjustment is accomplished by loosening frame fasteners 263. While frame fasteners 263 are loosened, base fasteners 265 are not allowed to turn, since the flat sides of heads 271 are restrained by wide slot portions 283. Thus, loosening of the fasteners can be accomplished with only one tool. Once fasteners 263 and 265 are loosened, longitudinal and lateral adjustment is made, after which, fasteners 242 and 244 are again tightened. The tightening of fasteners 263 and 265 creates enough friction between the top surface of brackets 246

and 248 and the bottom surface of ridges 257 and 259 so that movement of one with respect to the other is prevented.

FIGURE 23 illustrates the preferred configuration of base support ribs 261. Base support ribs 261 include a peripheral rib 293 that extends around base portion 239, inward of the outside contours of base portion 239. Peripheral rib 293 extends around the perimeter of base portion 239, near the outer edges of base portion 239. Cross ribs 295 form cross patterns within peripheral rib 293 between forward ridge 257 and rearward ridge 259 and extend radially forward of forward ridge 257, from a point at about the middle of the forward side of forward ridge 257. Peripheral ribs 293 and cross ribs 295 provide torsional, longitudinal, and lateral structural support to base portion 239, while not adding significantly to the weight of base portion 239.

Referring now to FIGURES 24 and 25, there is shown another embodiment of the boot upper 220', including the substantially nonelastic, but flexible strap 228. FIGURE 25 shows the boot upper 220' attached to a lower frame 235 supporting a plurality of wheels 244. The strap 228 is fastened to a forward portion of the heel counter 241, with the in-line skate upright and facing forward. The strap 228 securely holds the skater's heel into the rearward portion of the heel counter 241. By securely holding the skater's heel into the heel counter, the semirigid and rigid support means, specifically, the base portion 239, the heel counter 241 and the ankle support cuff 223, are always properly positioned around the skater's foot, thereby providing the necessary support without having to add bulky rigid materials around less critical portions of the skater's foot. Without the strap 228, the skater's foot may float up and down within the boot upper 220', thereby allowing undesired movement of the skater's foot such that control of the skate is diminished.

Referring now to FIGURE 26, there is shown a perspective view of an embodiment of the present invention with the soft, pliable, breatheable portion 222 laminated in place on the base portion 239, as described above. As previously noted, the boot upper 220 may be attached to the lower frame in any of the preferred embodiments or, if the base portion 239 and the lower frame 235 are an integrally molded unit as shown in FIGURE 28, the breatheable portion 222 may simply be laminated thereto, such as by applying glue along the lower sides of the base portion 239, in the area of the heel counter 241 and the toe portion 224, and then curing.

Referring to FIGURE 27, there is shown a rear sectional view of the embodiment of FIGURE 26, illustrating the ankle support cuff 223, the soft, pliable,

breatheable portion 222, the lateral canting means 227, and the external heel counter 241. As discussed heretofore, adhesive may be applied at interface 248 to bond the breatheable portion 222 to the heel counter 241 and the base portion 239.

While the preferred embodiments of the invention have been illustrated and described, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an in-line roller skate having an upper shoe portion and a lower frame portion, said upper shoe portion being adapted to support a skater's foot, and said upper shoe portion being positioned upwardly adjacent said lower frame portion, said lower frame portion including a plurality of wheels rotatable in a common, longitudinally extending plane of rotation, the improvement wherein said upper shoe portion comprises:

a nonrigid shoe portion adapted to receive a skater's foot, said nonrigid shoe portion formed of a substantially soft, pliable material, said material adapted to allow air to circulate around said skater's foot;

support means interconnected with said nonrigid shoe portion for providing support for said upper shoe portion to aid said skater in maintaining said in-line roller skate in a substantially vertical position; and

means for interconnecting said upper shoe portion and said lower frame portion, wherein said means for interconnecting includes an interface provided by said support means.

2. The in-line roller skate of Claim 1, wherein said support means of said upper shoe portion includes an ankle support cuff for surrounding an ankle portion of said nonrigid shoe portion, said support means and said ankle support cuff being connected by fastening means, said ankle support cuff including means for securing said ankle support cuff to said skater's foot, wherein said ankle support cuff extends said support means upwardly from said interface between said lower frame portion and said upper shoe portion to a position above said skater's ankle, said ankle support cuff aiding said skater in maintaining said in-line roller skate in a substantially vertical position.

3. The in-line roller skate of Claim 1, wherein said support means of said upper shoe portion further includes a heel counter for cupping the heel of said skater's foot wherein said heel counter and said ankle support cuff are connected by a fastening means, said heel counter and said ankle support cuff vertically extending said support means upwardly from said interface between said lower frame portion and said upper shoe portion to a position above said skater's ankle to aid said skater in maintaining said in-line roller skate in a substantially vertical position.

4. The in-line roller skate of Claim 1, wherein said support means comprises:

an ankle support cuff for surrounding an ankle portion of said nonrigid shoe portion, said ankle support cuff having a strap for securing said ankle support cuff to said skater's foot;

a heel counter for cupping the heel of said skater's foot, wherein said heel counter and said ankle support cuff are connected by fastening means; and

a base portion, said base portion having an upper surface for receiving said skater's foot and a lower surface for providing an interface between said lower frame portion and said upper shoe portion, said ankle support cuff and said heel counter vertically extending said support means upward from said base portion to a position above said skater's ankle to aid said skater in maintaining said in-line roller skate in a substantially vertical position and wherein said ankle support cuff and said heel counter are attached to said base portion.

5. The in-line roller skate of Claim 4, wherein said heel counter is an integral part of said base portion, and further comprising fastening means for securing said nonrigid shoe portion to said heel counter and said integral base portion, said heel counter and said integral base portion aiding said skater in maintaining said in-line roller skate in a substantially vertical position.

6. The in-line roller skate of Claim 5, wherein said lower frame portion is an integral part of said base portion.

7. The in-line roller skate of Claim 4, wherein said support means further comprise a strap arranged and configured to pass over the instep of the foot of the skater, said strap being attached to said heel counter.

8. The in-line roller skate of Claim 4, wherein said base portion includes a first rim and a first and a second base fastener, said first rim forming a first base slot, said first base fastener being slidable within said first base slot, said first and second base fasteners being spaced from each other.

9. The in-line roller skate boot of Claim 8, wherein the base portion further comprises a second rim forming a second base slot longitudinally spaced from the first base slot, the second base fastener being slidable within the second base slot.

10. The in-line roller skate of Claim 2, wherein said nonrigid shoe portion substantially comprises an exterior woven fabric material and an interior open-cell foam padding, and wherein said nonrigid shoe portion also comprises an open-mesh material that allows air to circulate around said skater's foot.

11. The in-line roller skate of Claim 1, wherein said means for interconnecting said upper shoe portion to said lower frame portion includes means for adjusting the location of said upper shoe portion with respect to said lower frame portion.

12. The in-line roller skate of Claim 2, wherein said fastening means for connecting said ankle support cuff to said support means includes means for allowing said ankle support cuff to pivot forwardly and rearwardly with respect to said lower frame portion.

13. The in-line roller skate of Claim 2, wherein said fastening means for connecting said ankle support cuff to said support means includes means for allowing said ankle support cuff to pivot laterally with respect to said lower frame portion.

14. The in-line roller skate of Claim 1, wherein said support means for providing support for said upper shoe portion aids said skater in maintaining said in-line roller skate in a substantially vertical position, said support means being conformable to the shape of said skater's foot and comprising a substantially horizontal base portion, said horizontal base portion having an upper surface for receiving said skater's foot and a lower surface for providing an interface between said lower frame portion and said upper shoe portion, said upper surface of said base portion being substantially contoured to the shape of said skater's foot in contact therewith, said lower surface of said base portion including attachment means for securing said base portion to said lower frame portion, said attachment means allowing for lateral and longitudinal adjustment of said upper shoe portion with respect to said lower frame portion.

15. The in-line roller skate of Claim 14, wherein said base portion further includes an integral heel counter for cupping the heel of said skater's foot.

16. The in-line roller skate of Claim 14, wherein said base portion further includes a raised support on either side of said base portion, adjacent the ball of said skater's foot, for supporting said skater's foot laterally on said base portion.

17. The in-line roller skate of Claim 14, wherein said base portion further includes support means integrally connected to said base portion, for providing support for the bottom of said skater's foot.

18. The in-line roller skate of Claim 1, wherein said support means are semirigid and are formed at least in part of heat-moldable plastic adapted to be conformed to the shape of the skater's foot by heating said plastic material to soften it and allowing it to cool while said skater's foot is positioned within said upper shoe portion in contact with said support means.

19. In an in-line roller skate having an upper shoe portion and a lower frame portion, said upper shoe portion being adapted to support a skater's foot and positioned upwardly adjacent said lower frame portion, said lower frame portion including a plurality of wheels rotatable in a common, longitudinally extending plane of rotation, the improvement wherein said upper shoe portion comprises:

a base portion having an upper surface adapted to receive a skater's foot and a lower surface providing an interface between said lower frame portion and said upper shoe portion, said upper surface of said base portion including integral heel counter means, said lower surface having attachment means for securing said footbed portion to said lower frame portion, said attachment means including means for adjusting the position of said upper shoe portion with respect to said lower frame portion;

a nonrigid, soft, pliable shoe portion interconnected with said base portion and including means for permitting air to freely circulate around said skater's foot, said shoe portion including an outer durable portion and an inner soft portion for providing comfort to said skater; and

an ankle support cuff extending upwardly from said heel counter means, said ankle support cuff adapted to aid said skater in maintaining said in-line roller skate in an upright position while skating, said ankle support cuff being disposed within said outer durable portion of said nonrigid, soft, pliable shoe portion.

20. The in-line roller skate of Claim 19 wherein said nonrigid, soft, pliable shoe portion is formed of an external woven fabric material and an internal open-cell foam padding, wherein said external woven fabric material and said internal open-cell foam padding allow air to circulate therethrough around said skater's foot.

21. The in-line roller skate of Claim 19, wherein said support means further comprise a strap arranged and configured to cross the skater's instep for

holding the skater's foot to the base portion, the strap being secured to the base portion on either side of the skater's foot.

22. The in-line roller skate of Claim 19, wherein said base portion includes a sole and a heel, said sole having a downward protruding peg and said heel having a downward protruding hook.

23. In an in-line roller skate comprising an upper shoe portion for supporting a skater's foot, and a lower frame portion attached to said upper shoe portion for supporting a plurality of in-line wheels, said lower frame portion including a speed control for controlling a skater's speed, said speed control comprising:

a friction plate adapted to bear against the running surface of at least one of said plurality of in-line wheels;

means for normally biasing said friction plate in a direction away from said plurality of in-line wheels; and

speed control actuating means for moving said friction plate in a direction toward at least one of said plurality of in-line wheels, whereby said friction plate contacts and slows the speed of rotation of said at least one of said plurality of in-line wheels.

24. The speed control of Claim 23, wherein said speed control actuating means comprise pivotally mounted lever means for moving said friction plate toward at least one of said plurality of in-line wheels so that said friction plate contacts at least one of said plurality of in-line wheels to slow any rotation thereof.

25. A skate comprising:

(a) a base having first and second longitudinal slots and first and second base fasteners, the first base fastener being slidable within the first longitudinal slot and the second base fastener being slidable within the second longitudinal slot; and

(b) a frame coupled to said base, said frame having first and second transverse slots and first and second frame fasteners slidably engaged within the first and second transverse slots, respectively, the first and second frame fasteners being engaged with the first and second base fasteners, respectively.

26. The skate of Claim 25, wherein the first and second longitudinal slots each include a narrow slot portion and a wide slot portion having a greater width than

the narrow slot portion, the narrow slot portion being disposed below the wide slot portion, and wherein the first and second base fasteners include head portions that are nonrotatably engaged within the wide slot portions of the first and second longitudinal slots, respectively.

27. The skate of Claim 26, wherein said base includes a cross-ribbed support structure projecting from its bottom surface to increase the torsional stiffness of the base.

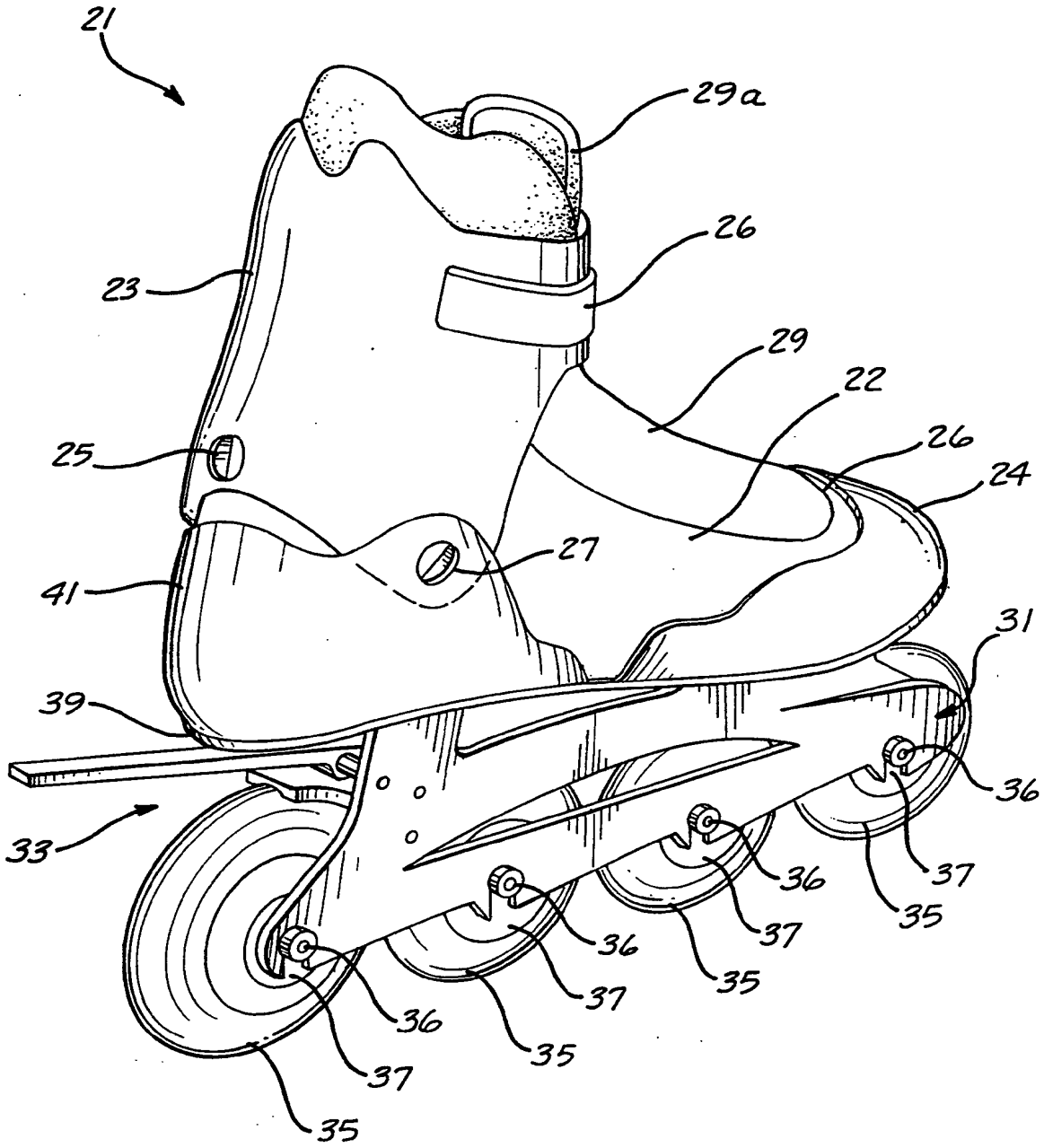
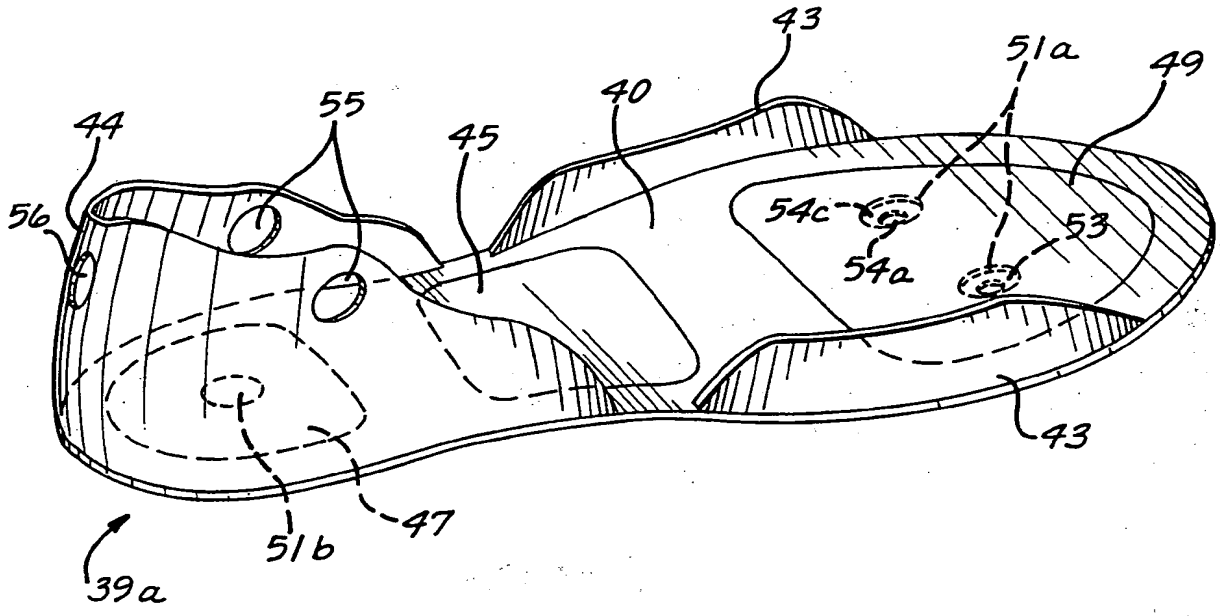


Fig. 1.

Fig. 2A.



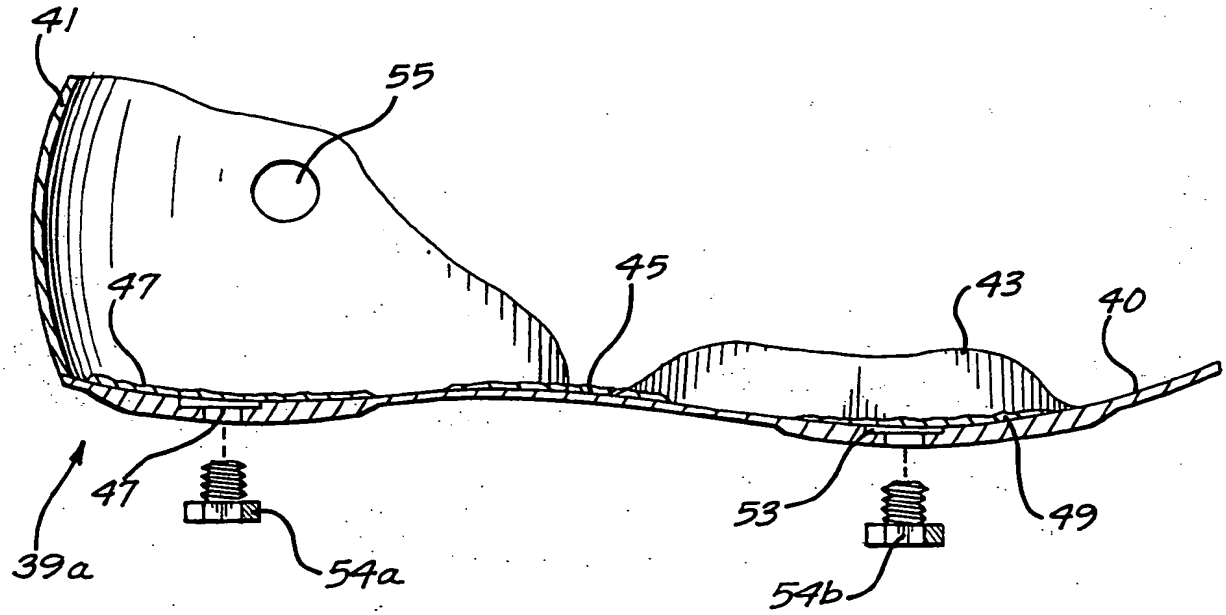


Fig. 3A.

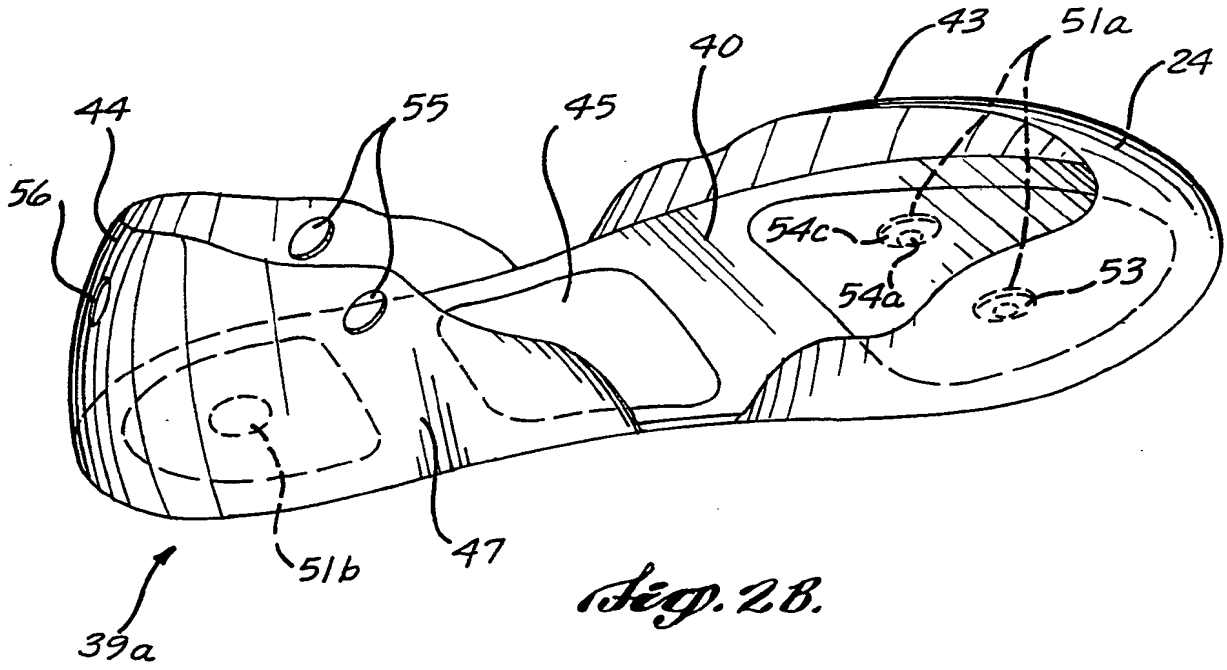


Fig. 2B.

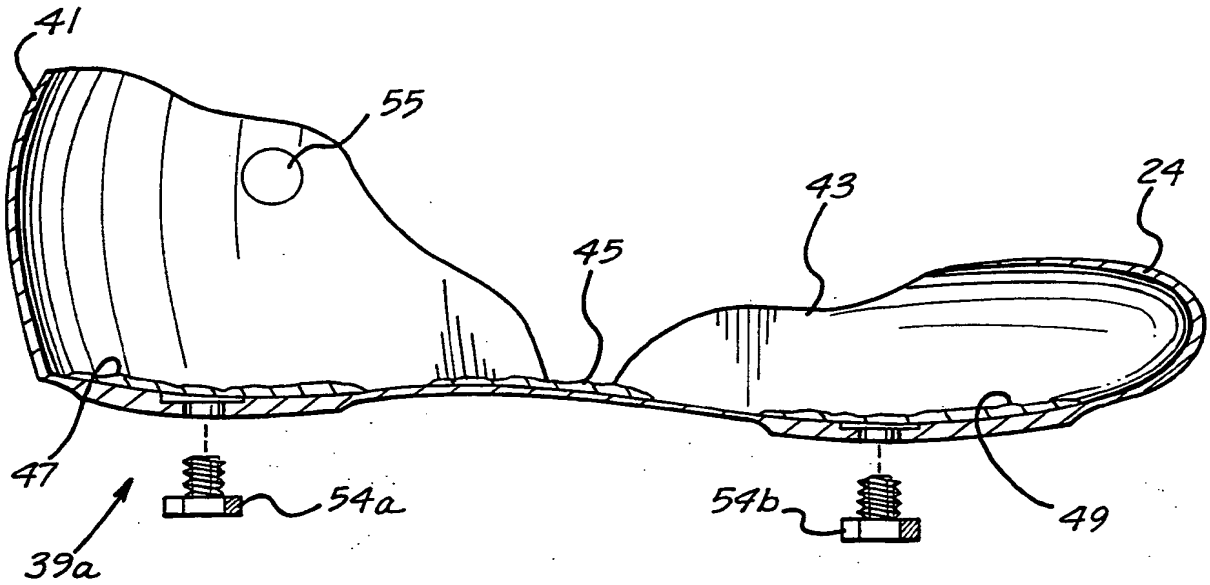


Fig. 3B.

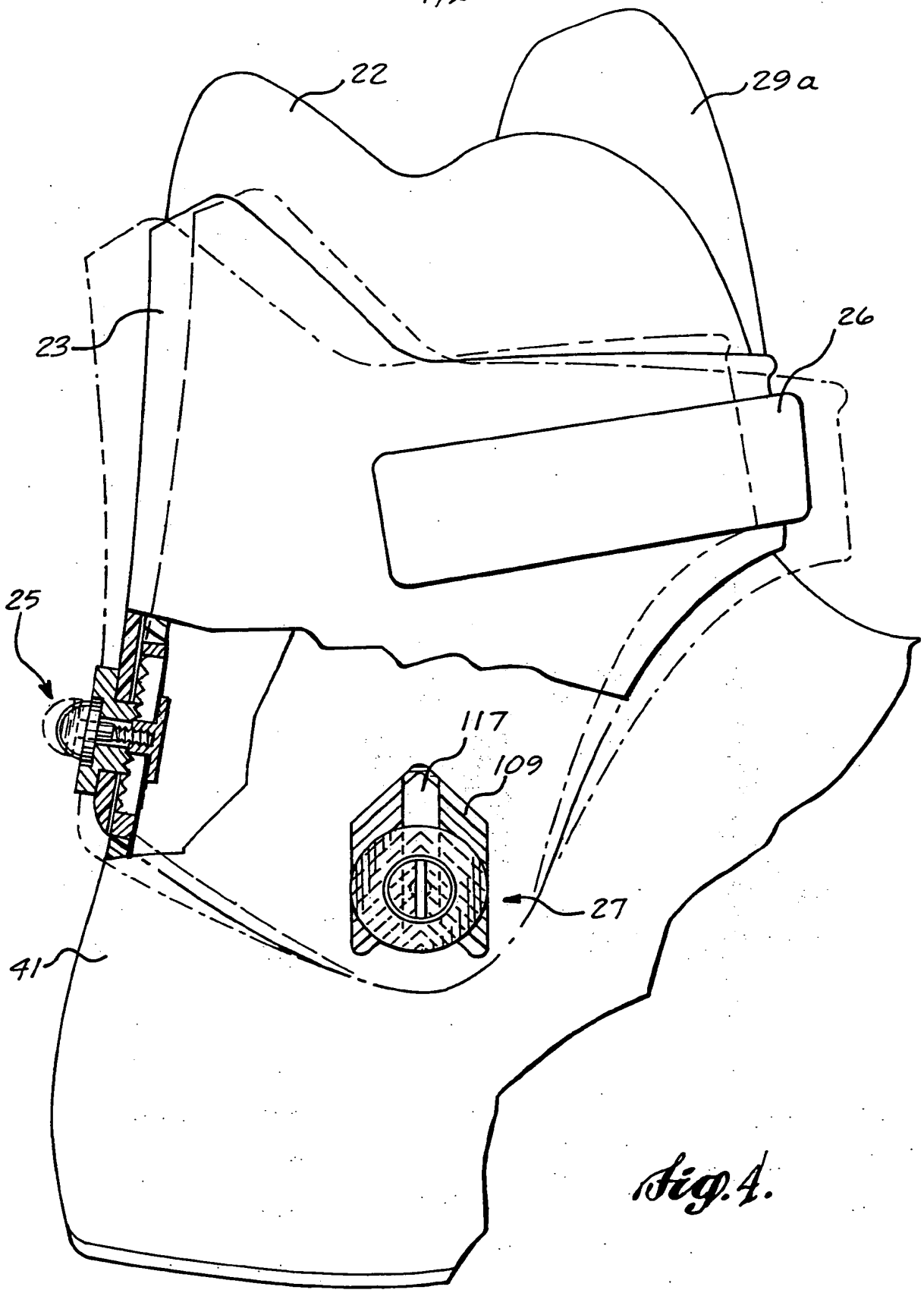


Fig. 4.

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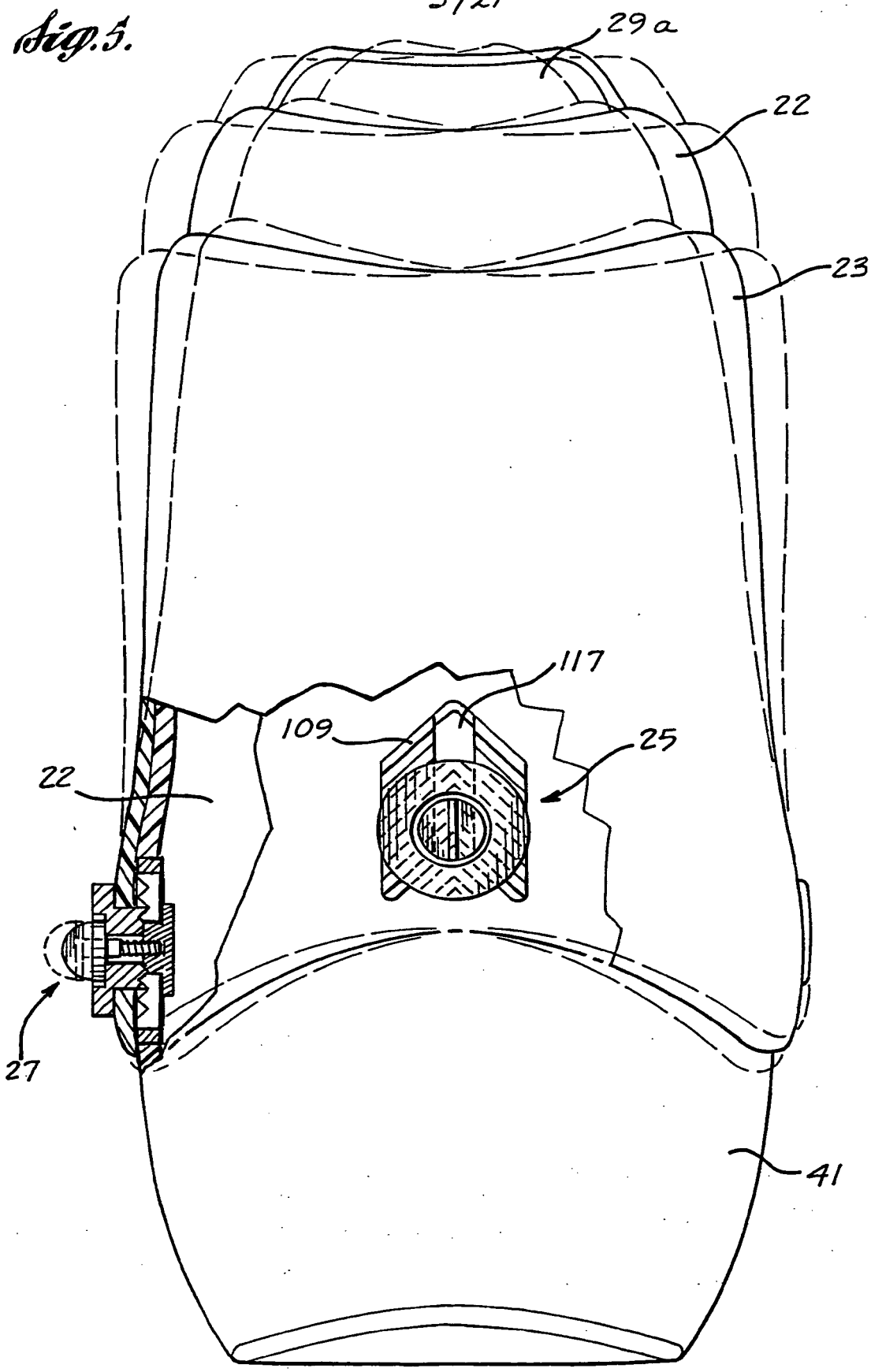
Fig. 5.



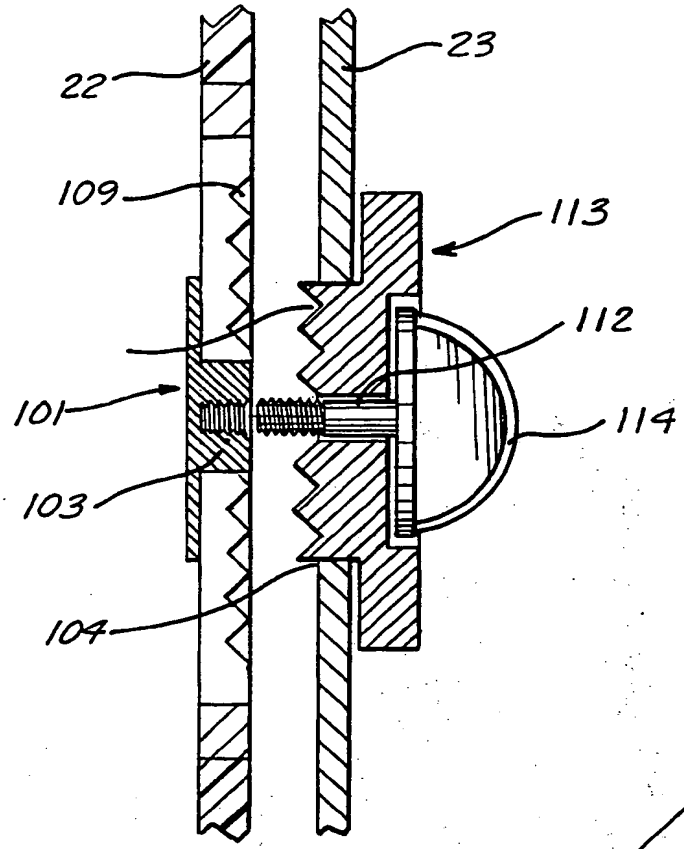


Fig. 6.

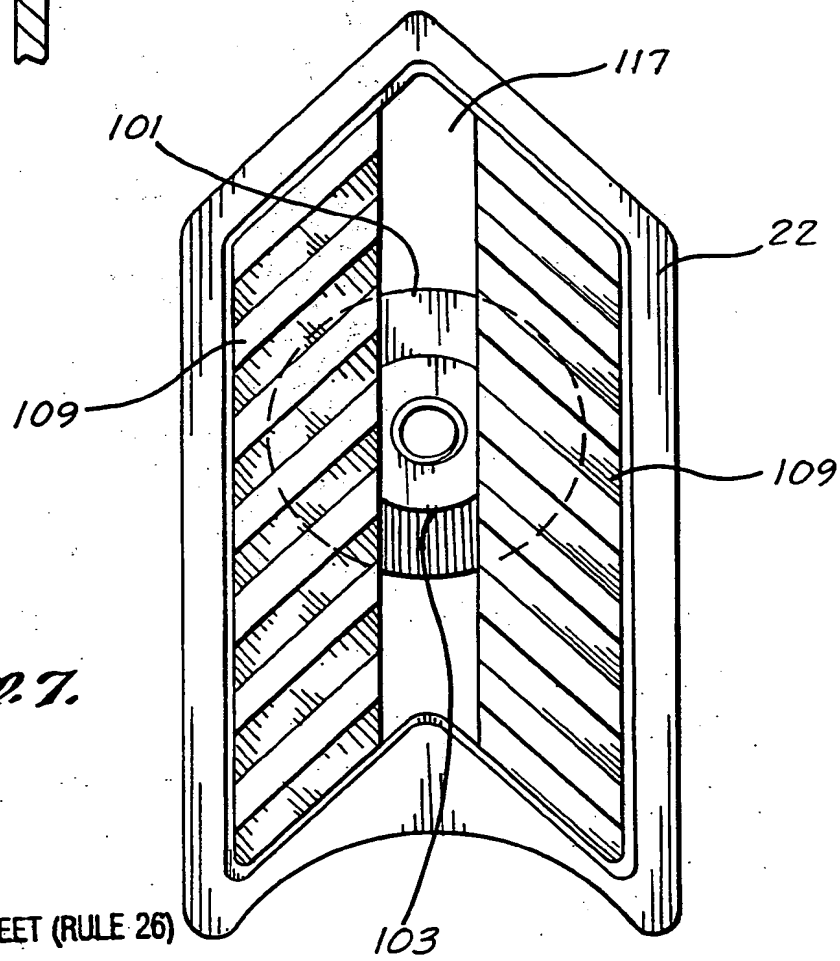


Fig. 7.

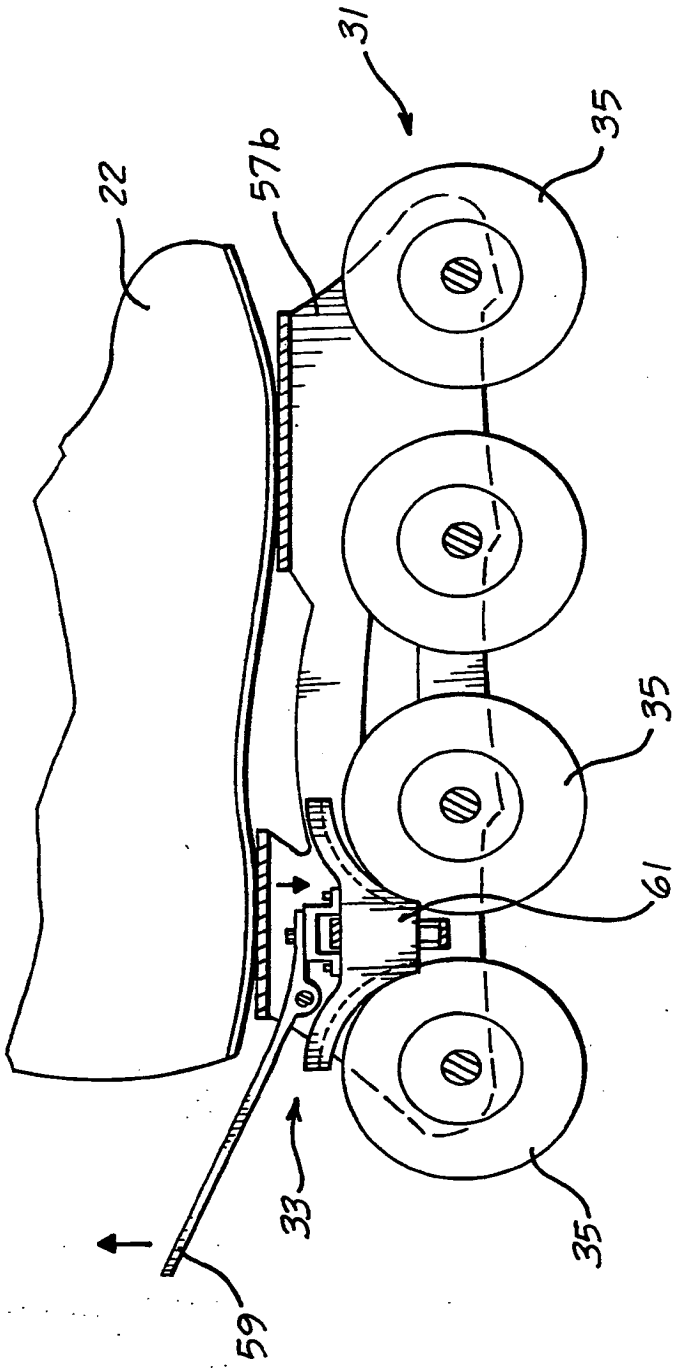


fig. 8.

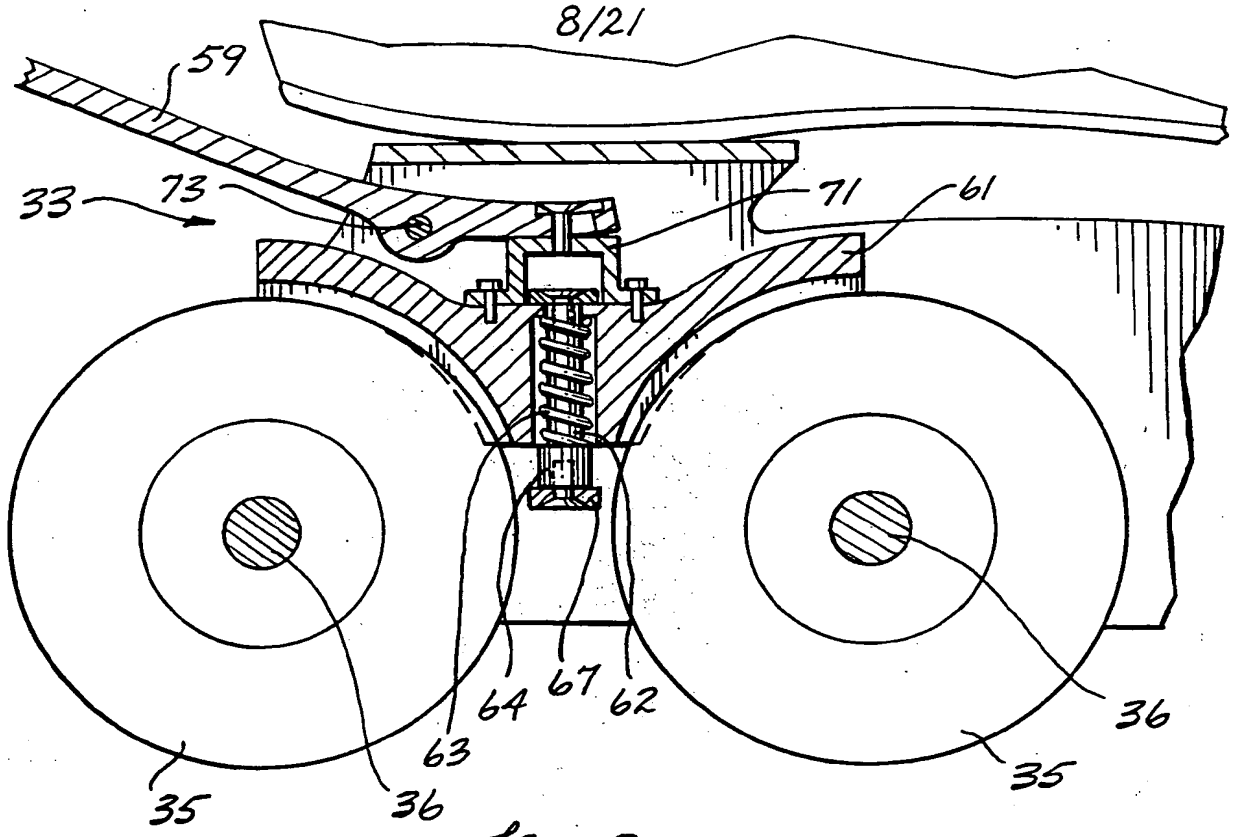


Fig. 9.

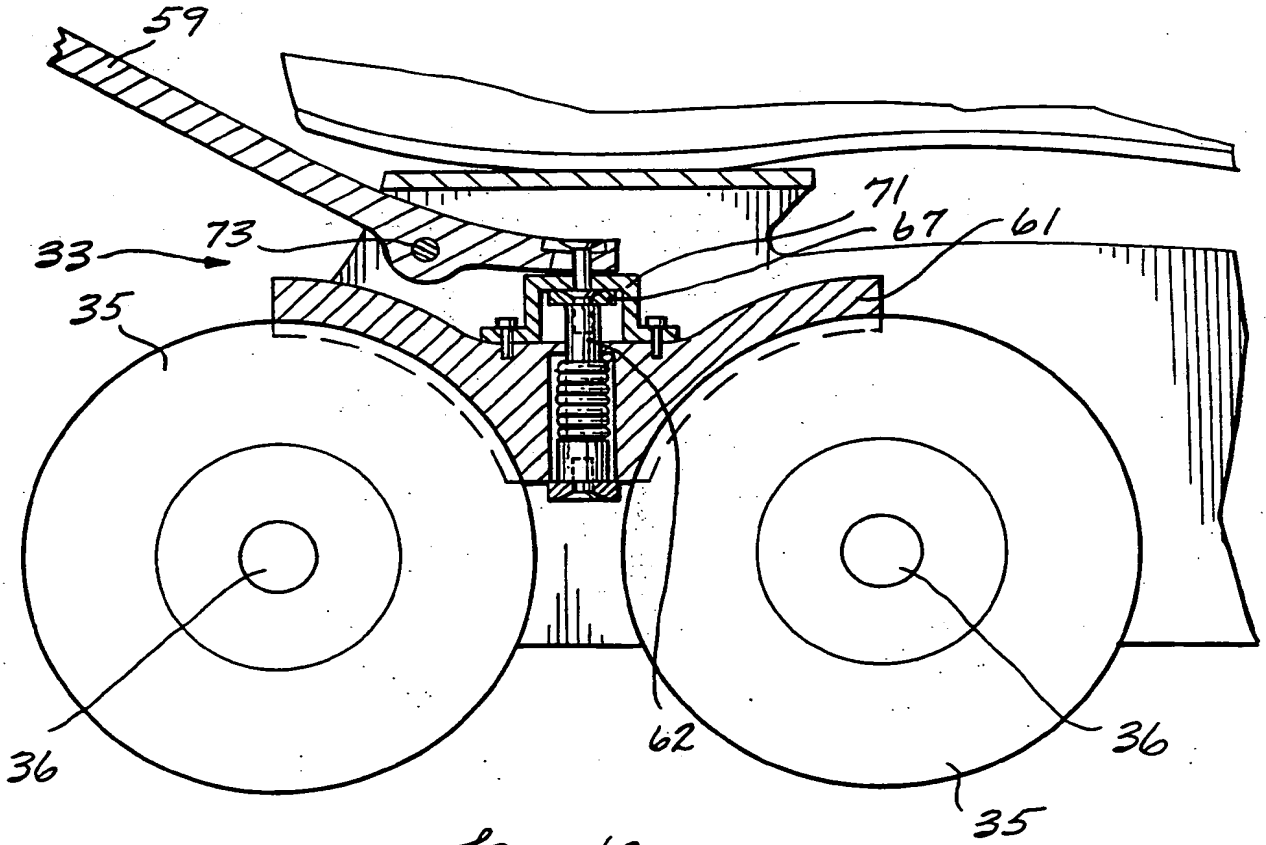
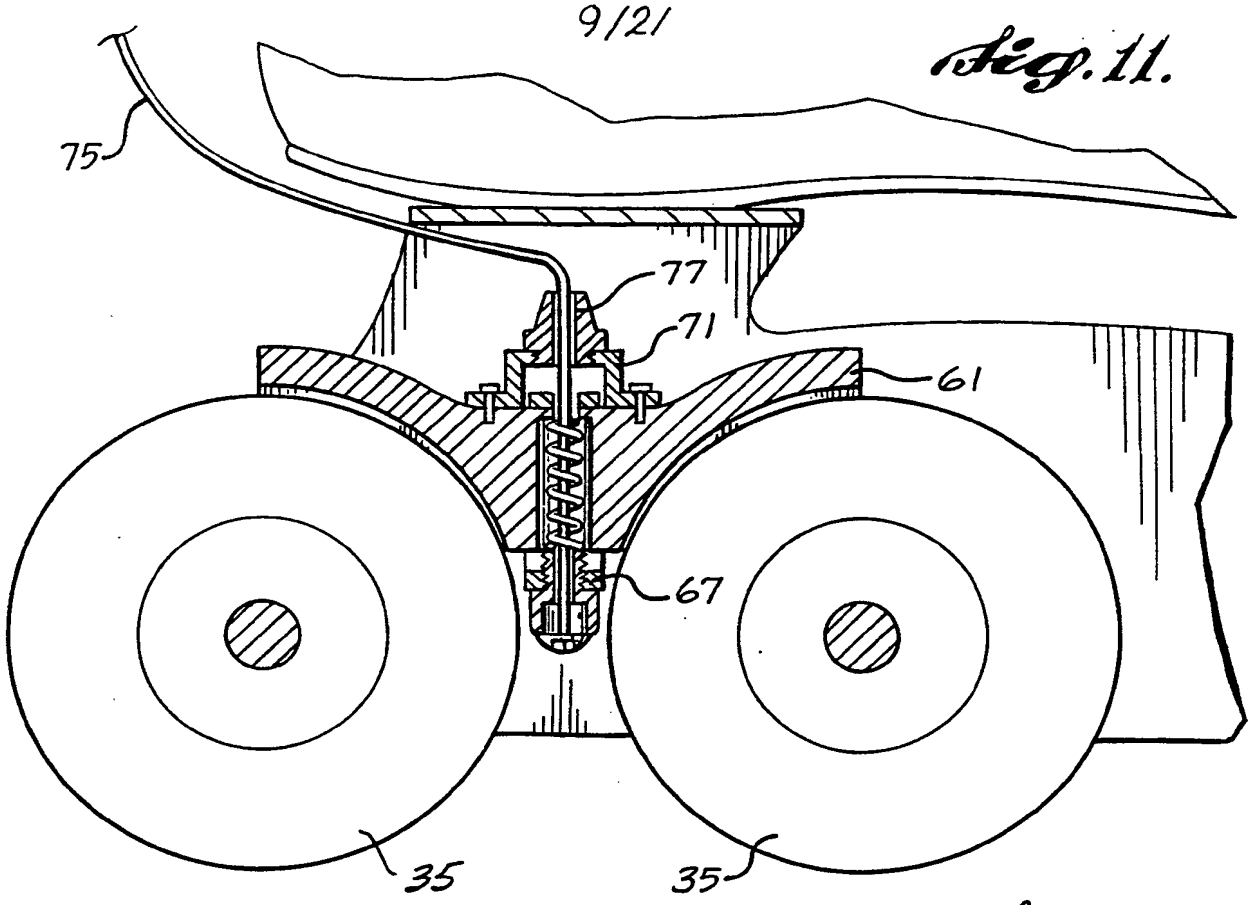


Fig. 10.

Fig. 11.



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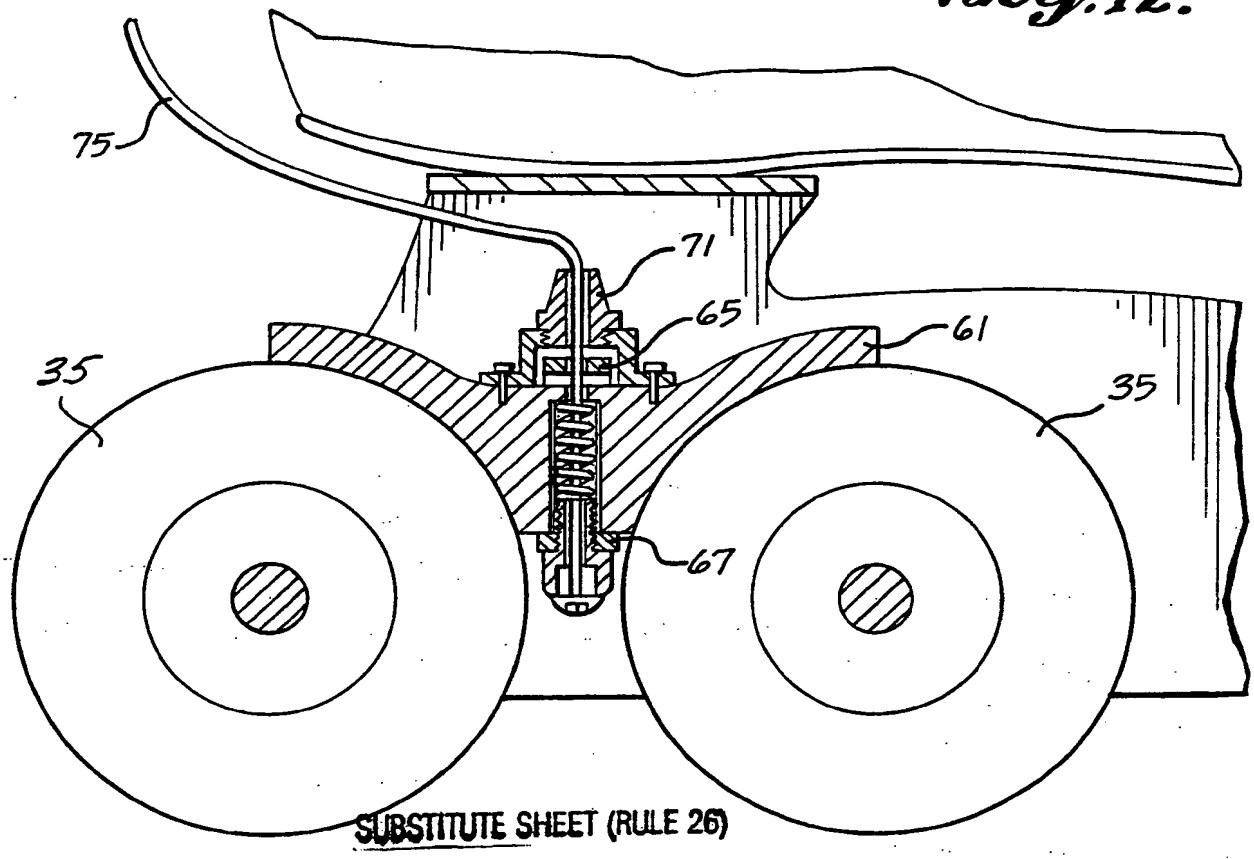


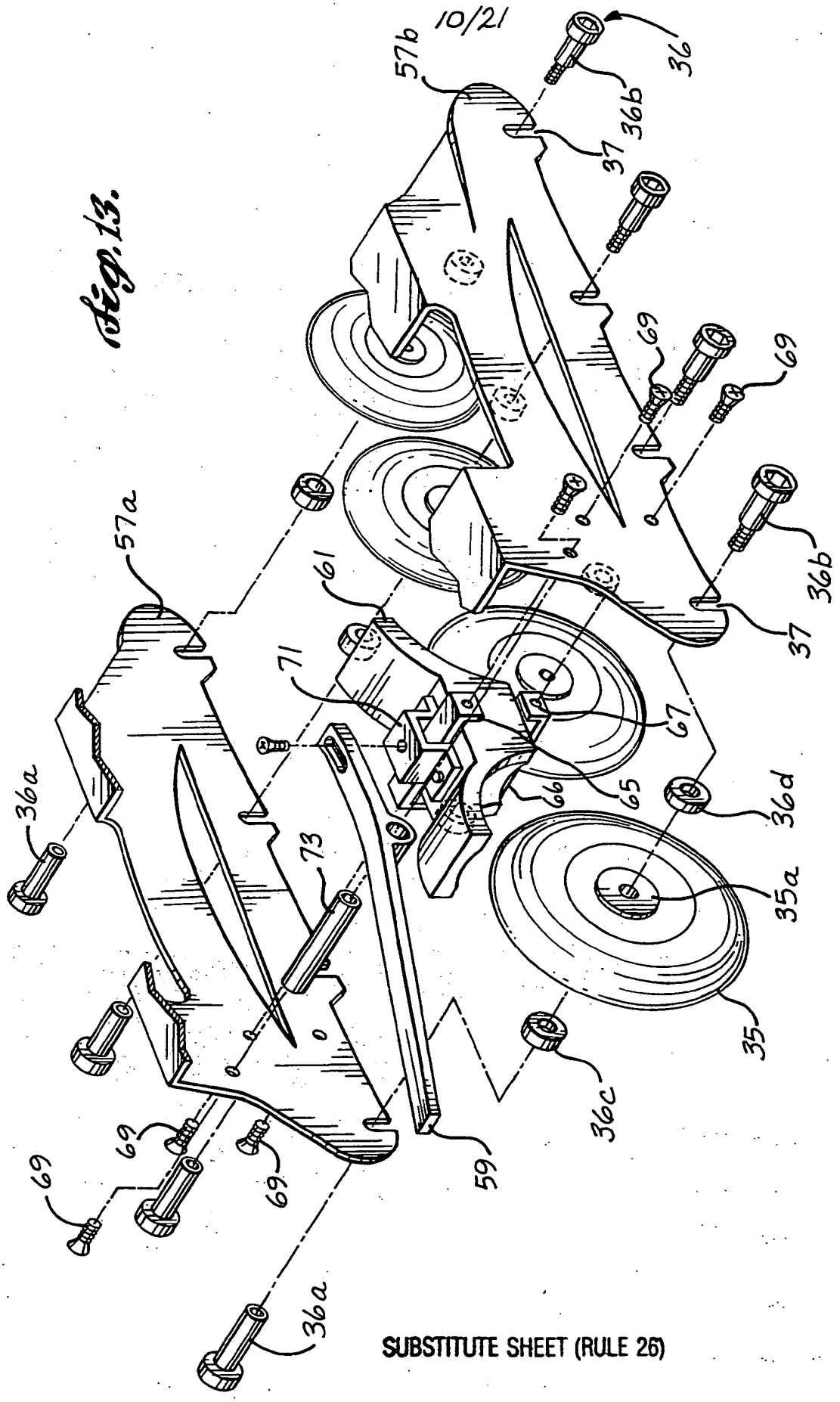


Fig. 13.

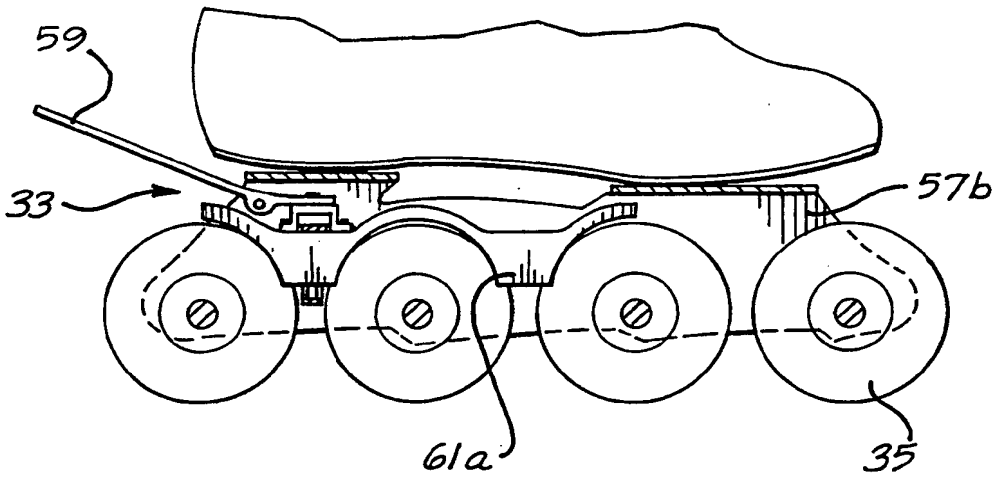


Fig. 14.

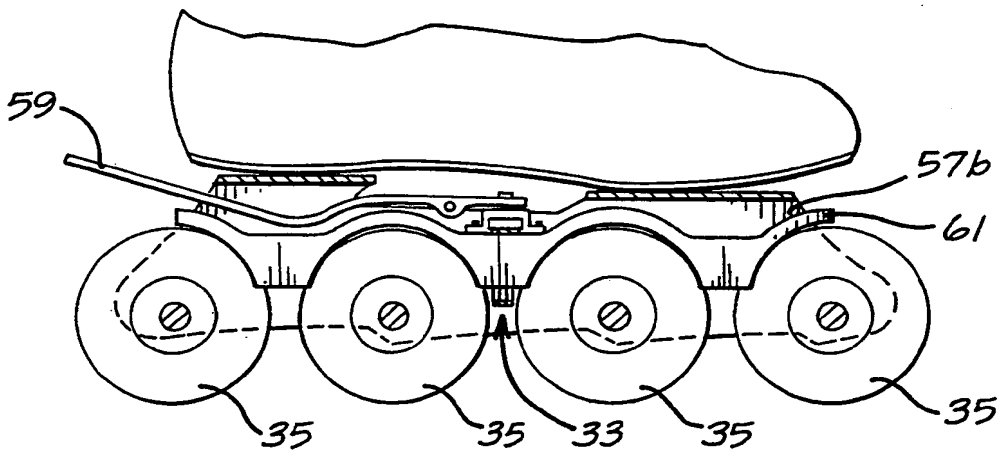


Fig. 15.

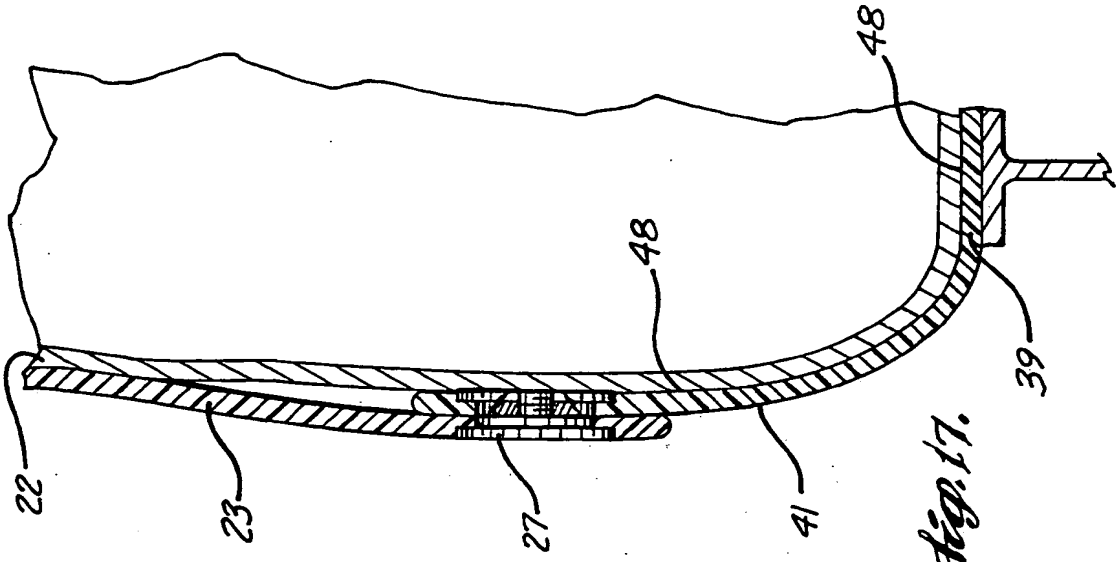


fig. 17.

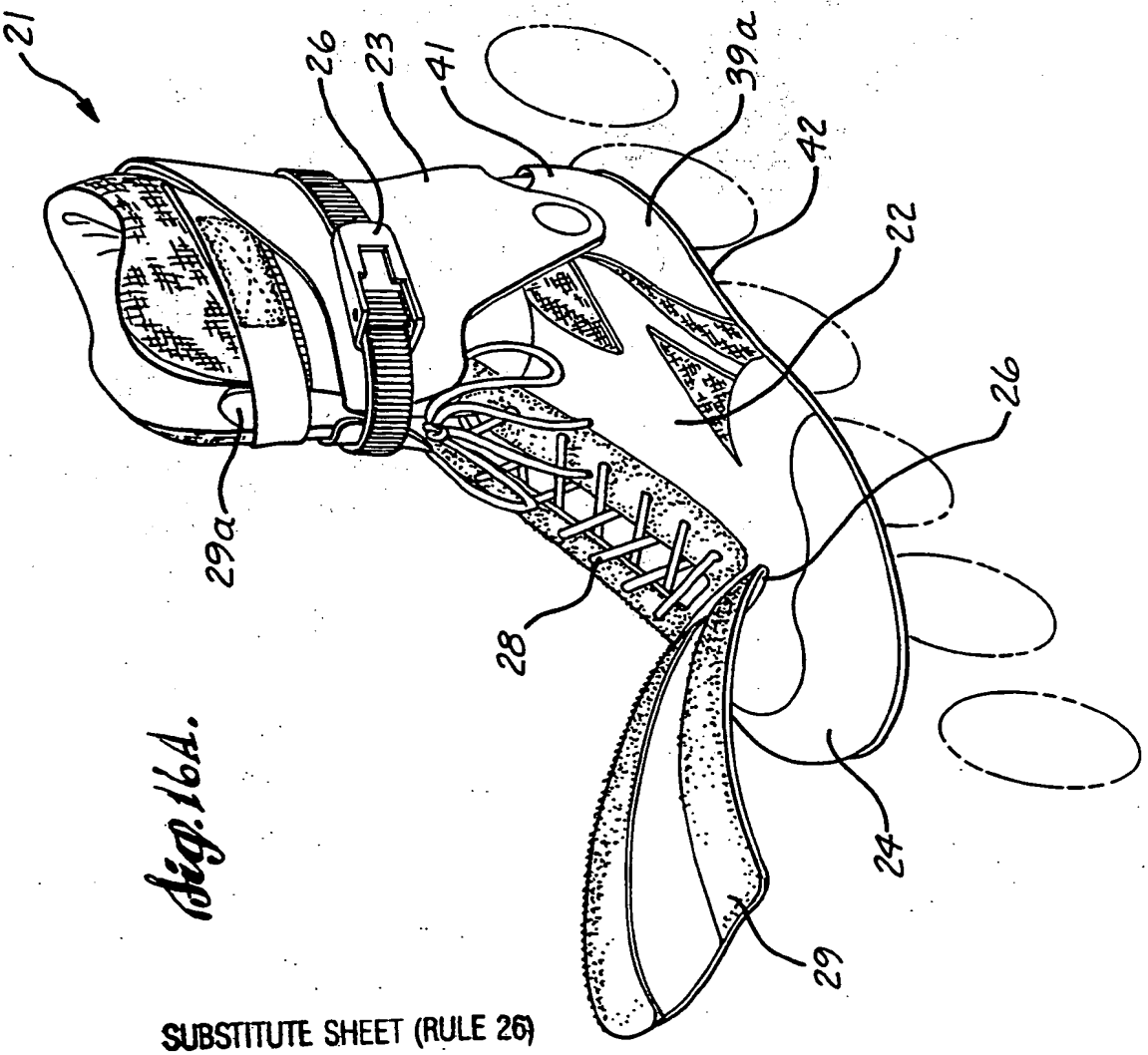


fig. 16A.

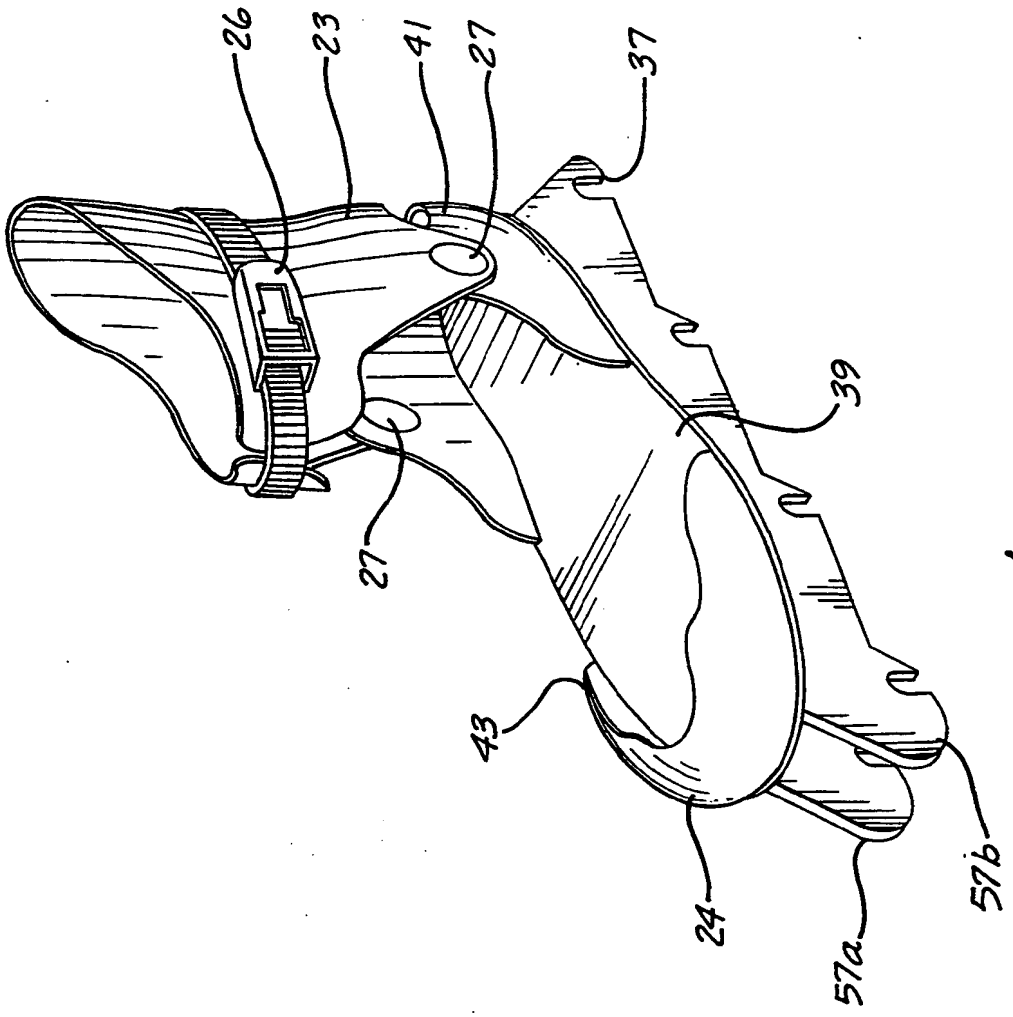


Fig. 16B.

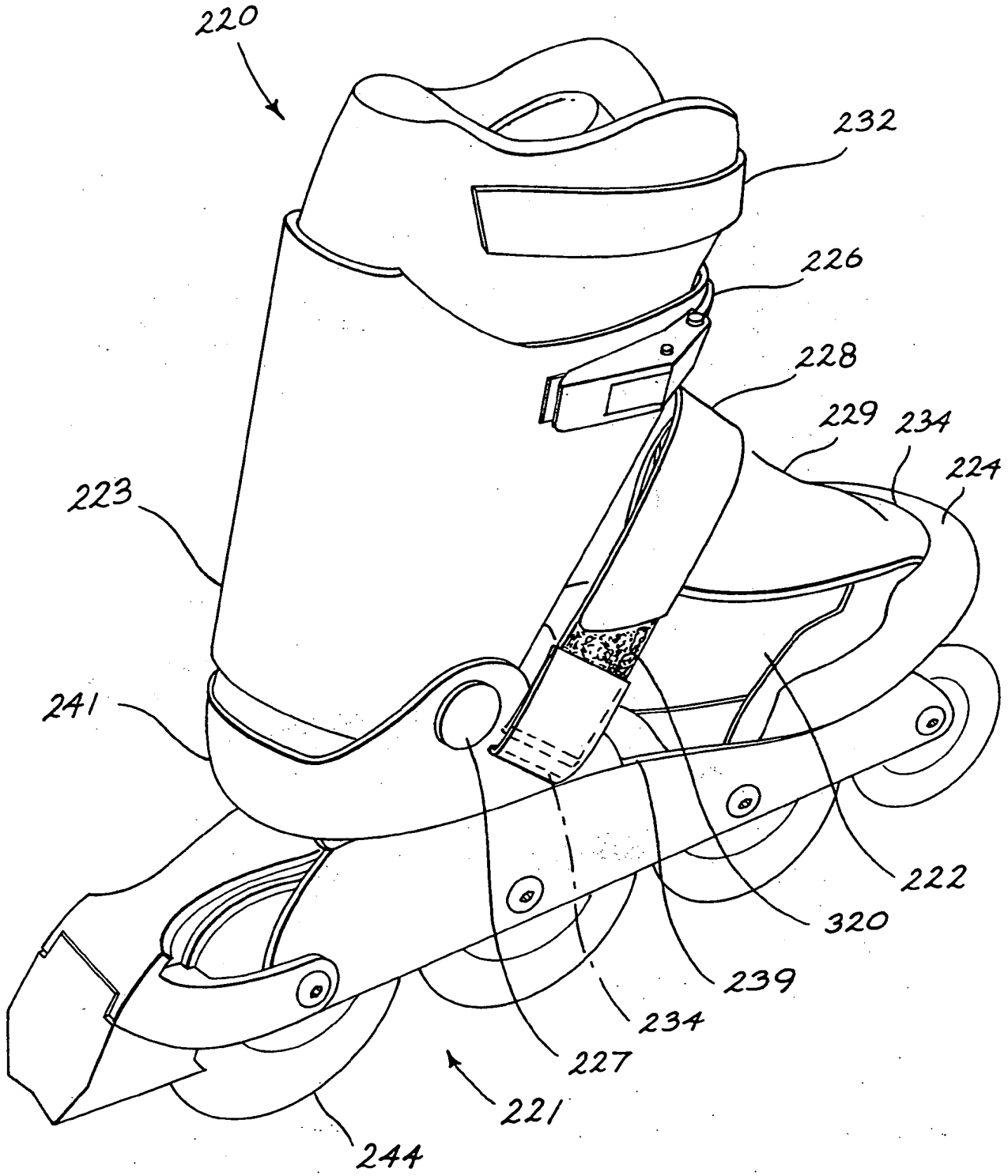


Fig. 16.

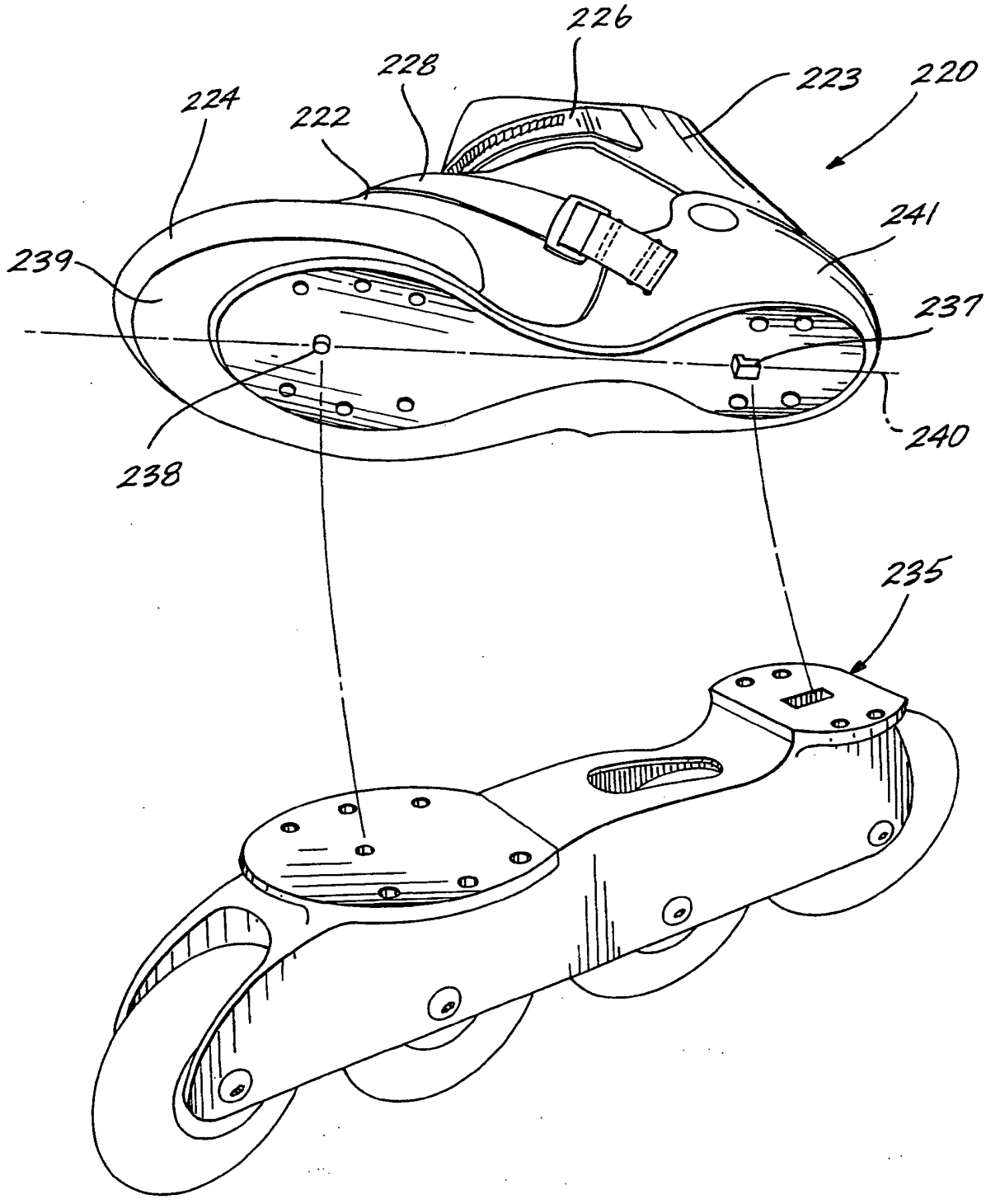


Fig. 19.

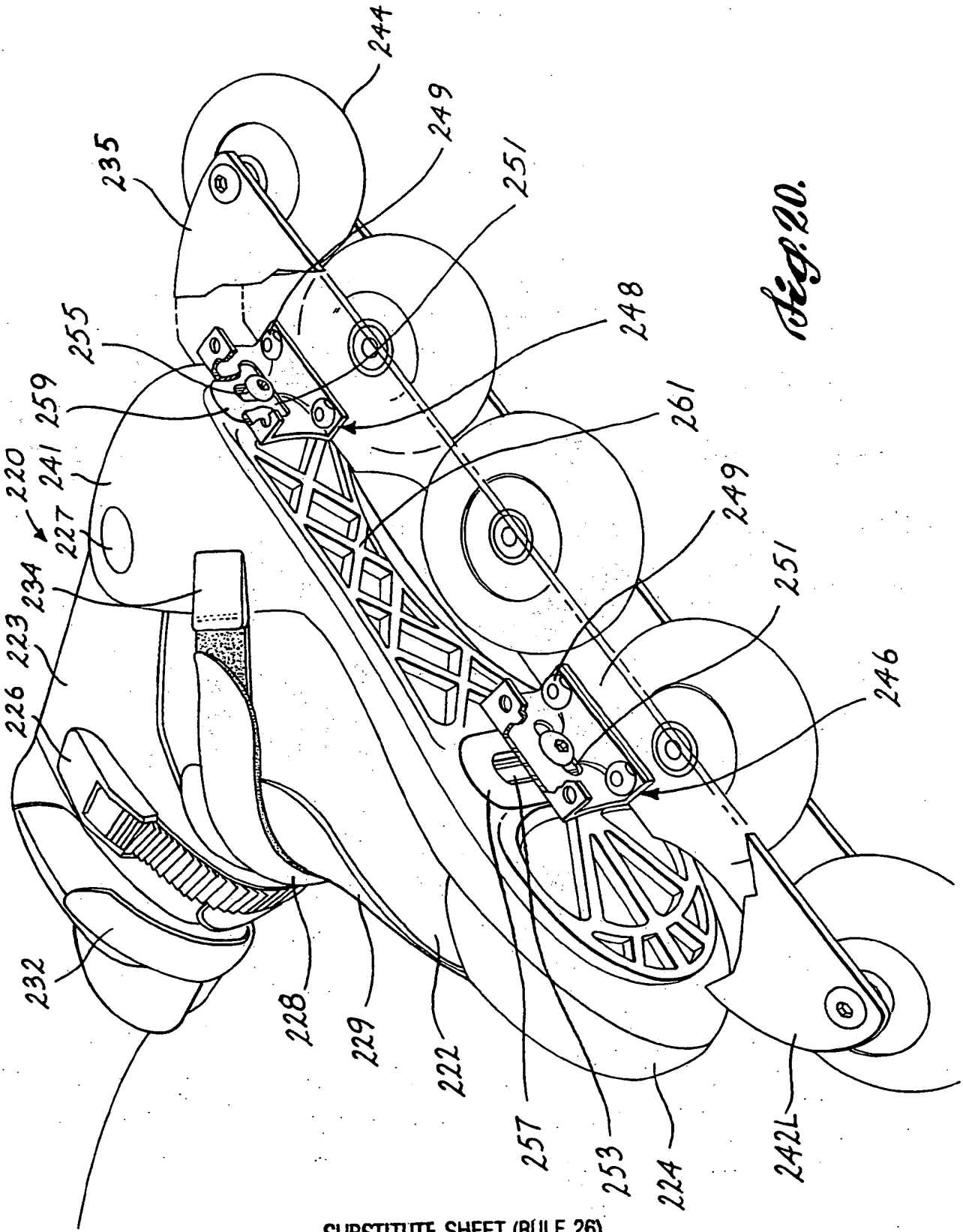
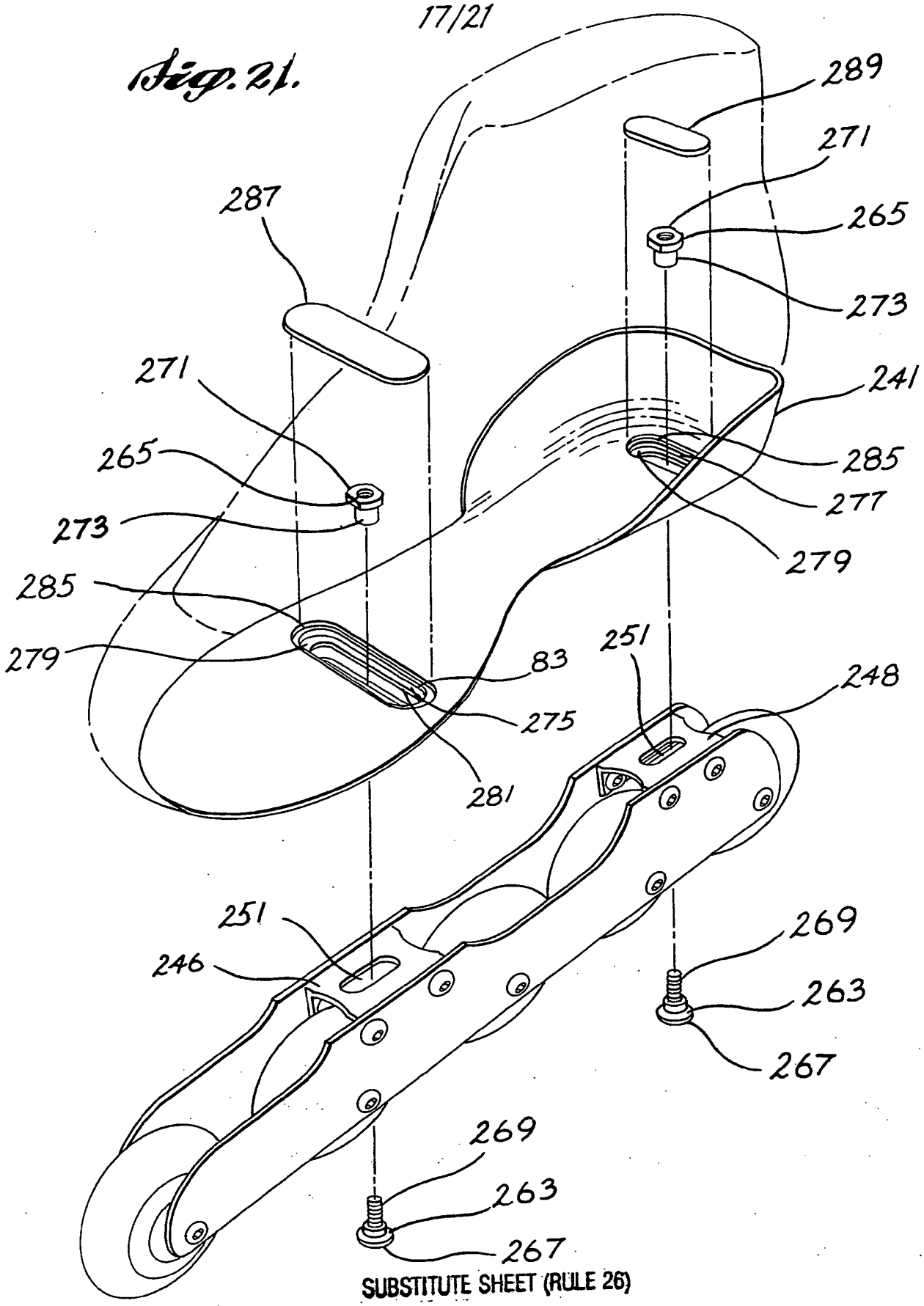


fig. 20.

Fig. 21.



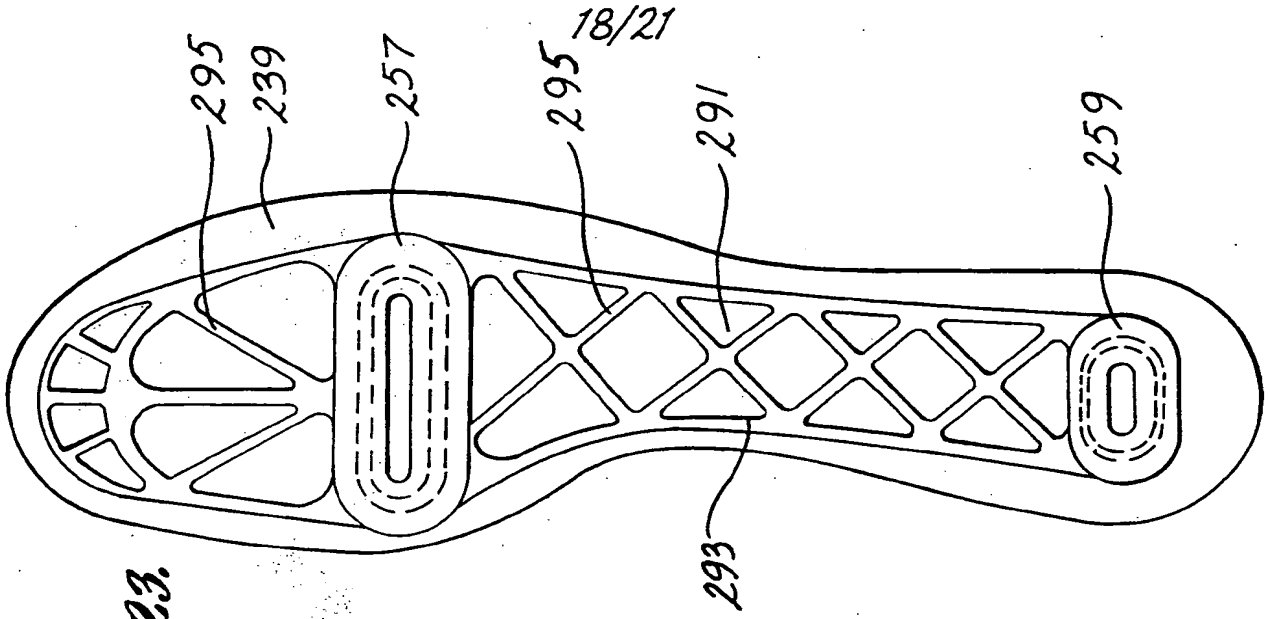


fig.23.

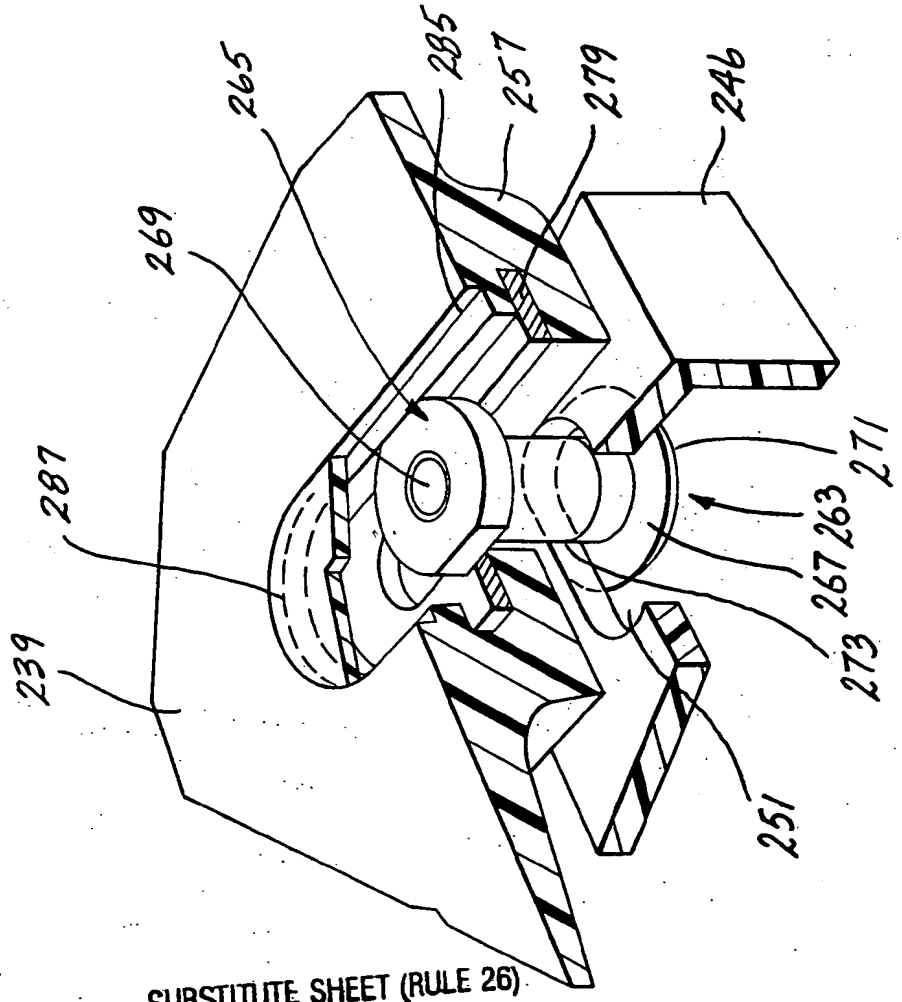


fig.22.

Fig. 24.

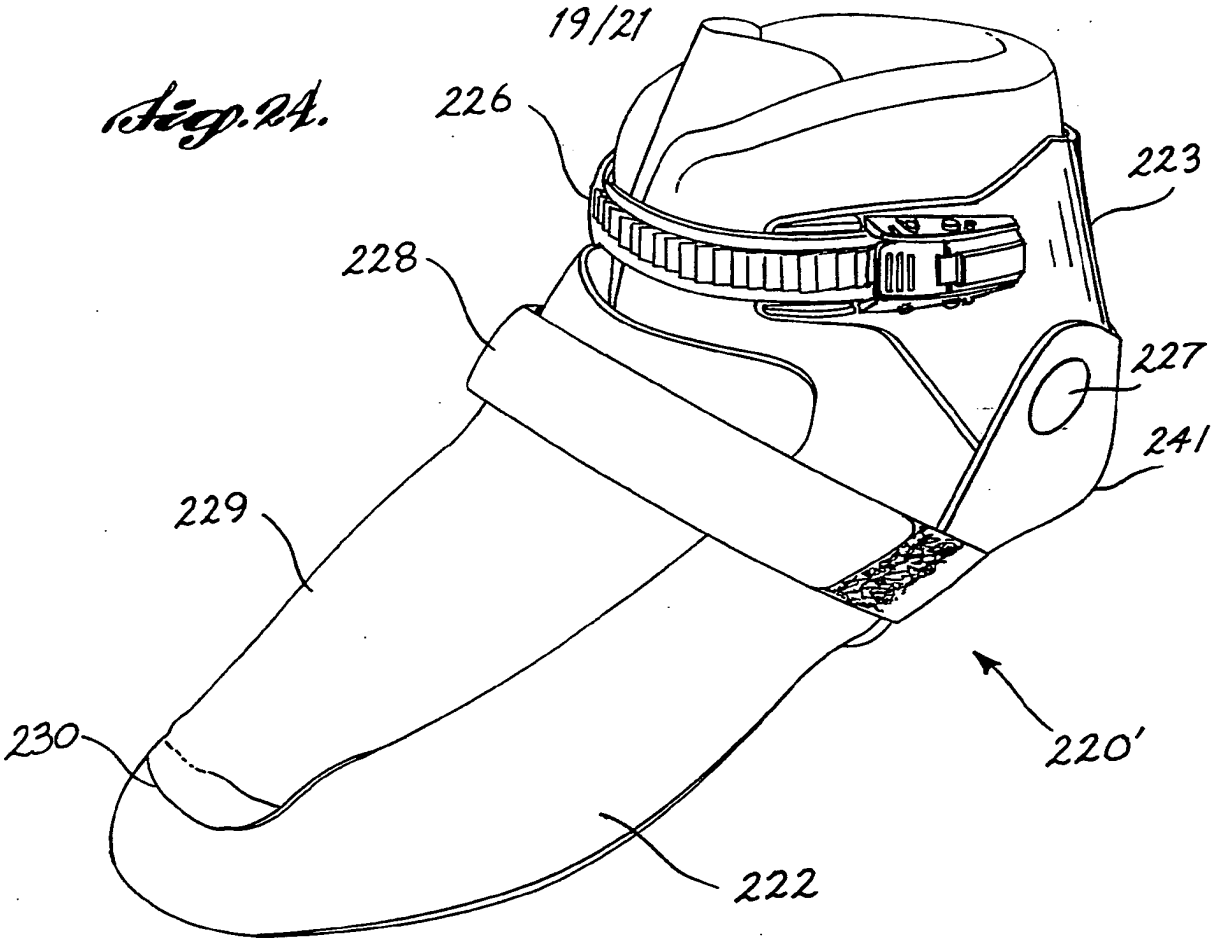
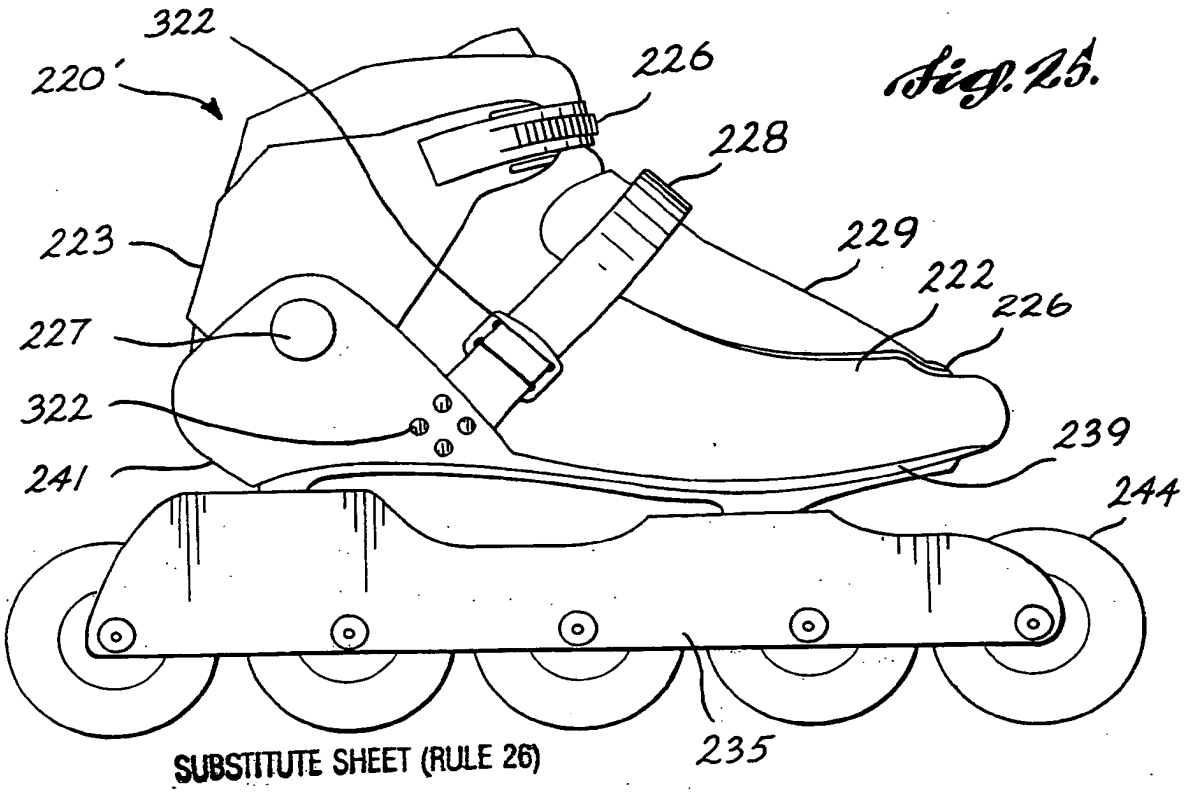


Fig. 25.



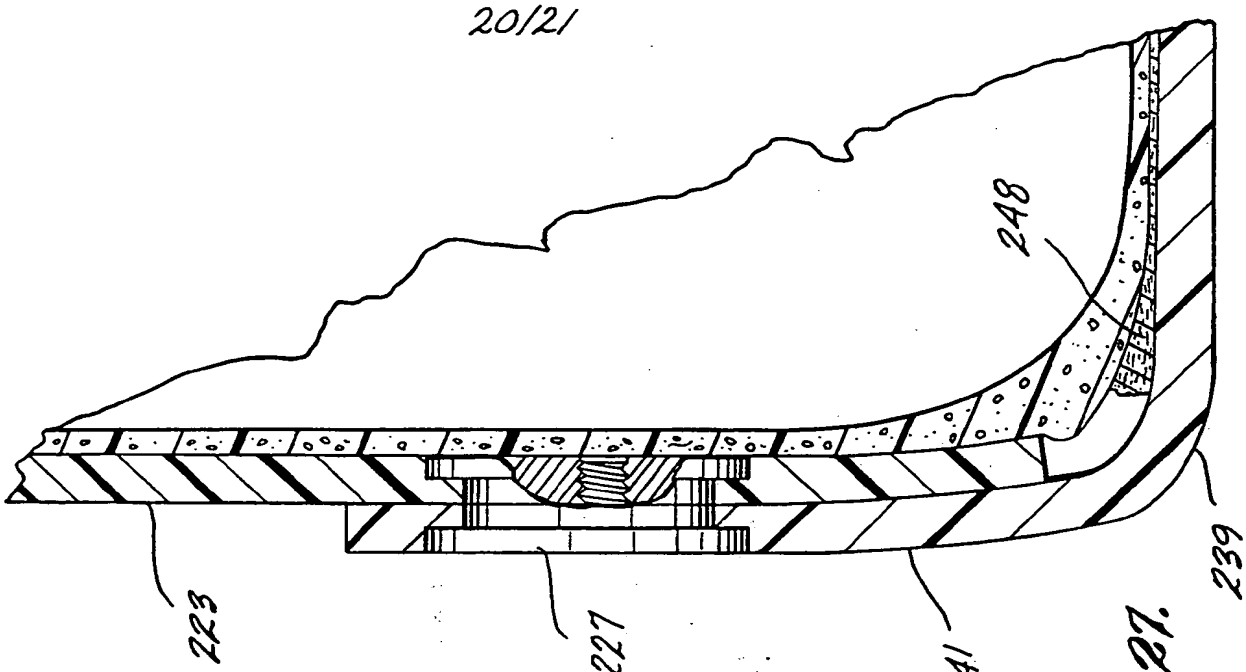


Fig. 27.

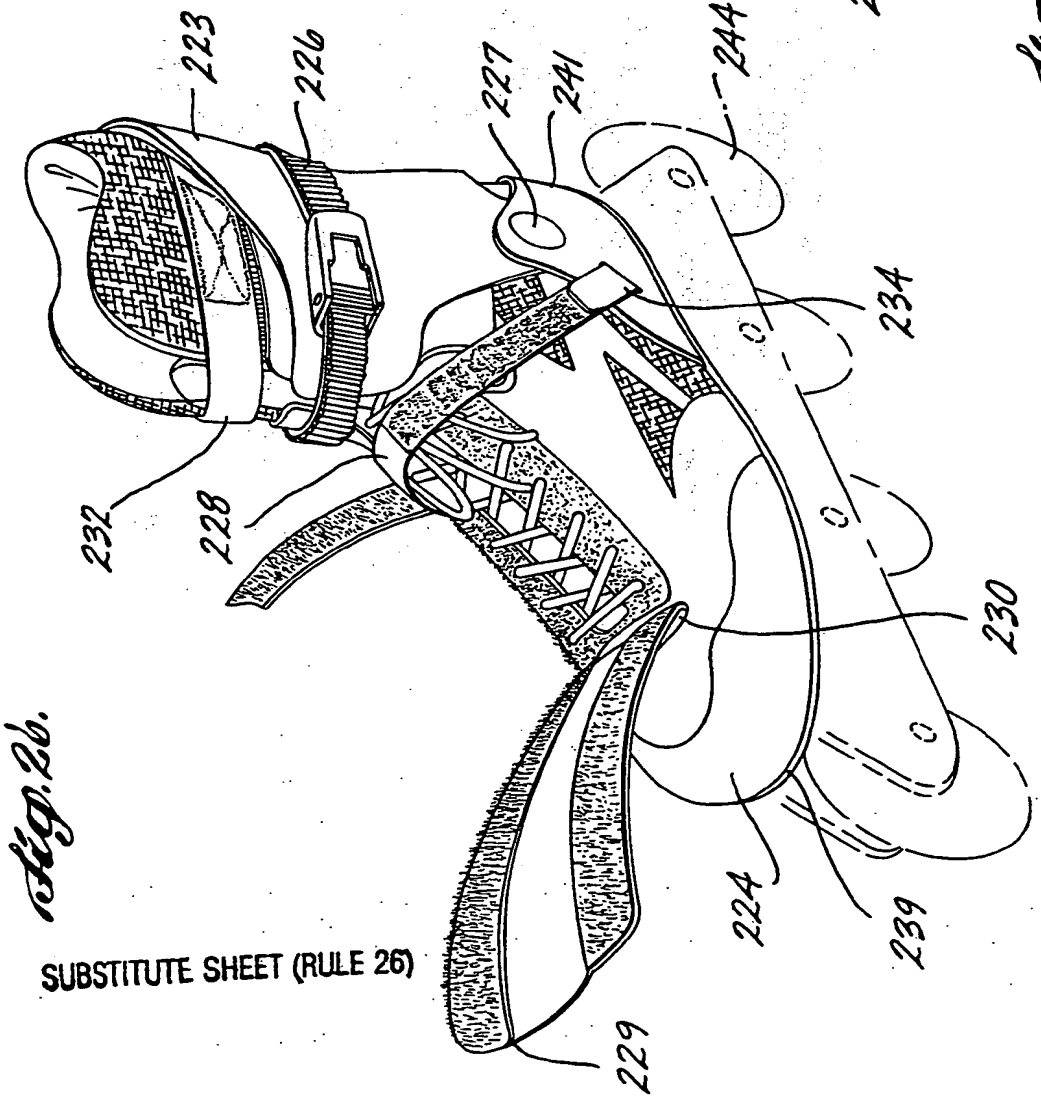


Fig. 26.

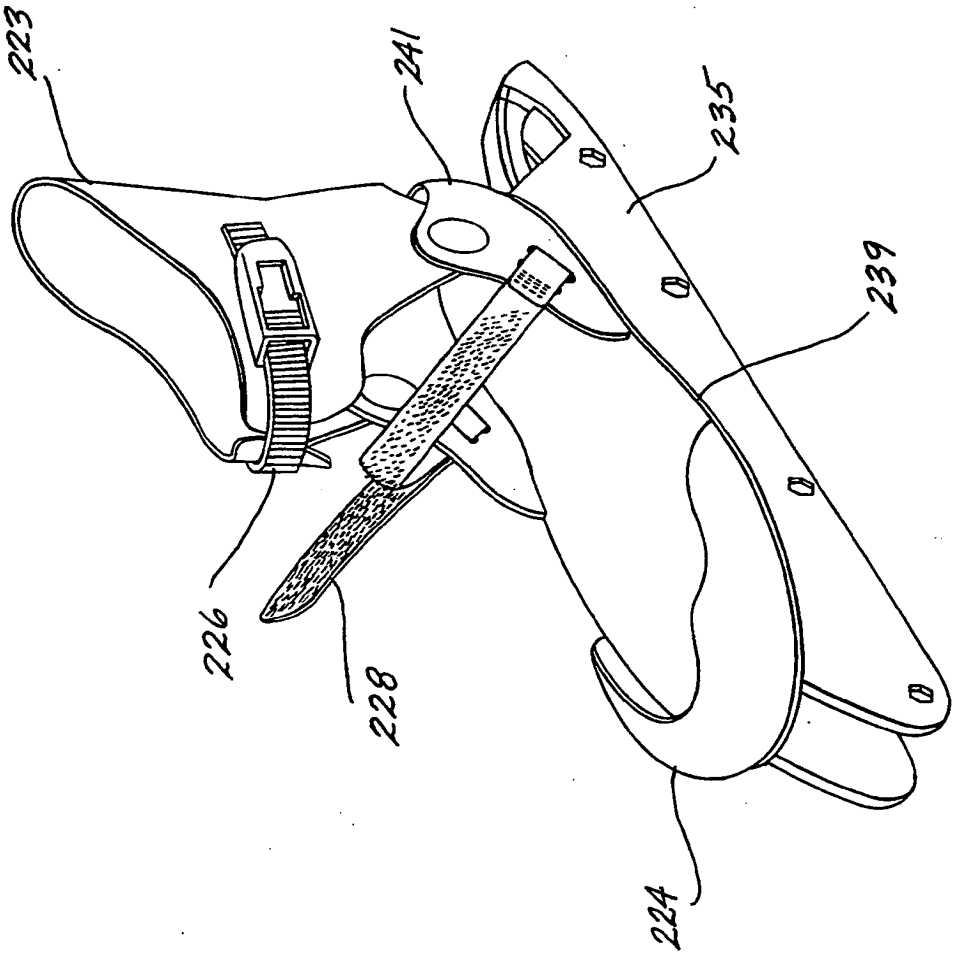


fig. 28.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/08155

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) :A63C 17/06
US CL :280/11.22
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 280/11.22, 11.19, 11.2, 11.27, 11.3, 11.23; 36/62, 115, 3A, 3R; D2/276, 265, 275; D21/225, 226

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, E --- Y	US, A, 5,331,752 (JOHNSON ET AL) 26 July 1994, see entire document.	1-7, 10, 12, 13, 19-21 --- 1-24
Y	US, A, 4,275,895 (EDWARDS) 30 June 1981, see entire document.	23, 24
Y	US, A, 4,964,229 (LABERGE) 23 October 1990, col. 1 lines 17-21.	18
Y	US, A, 5,046,746 (GIERVELD) 10 September 1991, see entire document.	8, 11
Y	US, A, 916,289 (FITZGERALD) 23 March 1909, see entire document.	8, 11, 14-17, 25

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
13 November 1994

Date of mailing of the international search report
DEC 06 1994

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
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CARLA MATTIX
Telephone No. (703) 308-1113

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/08155

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,345,774 (POE ET AL) 24 August 1982, Figs. 2 and 3.	27
Y	WO, A, 9,211,908 (POZZOBON) 23 July 1992, see entire document.	8, 11, 14-17
Y	US, A, 3,526,976 (JACOBS) 08 September 1970, see entire document.	22
Y	US, A, 2,998,260 (MEYER) 29 August 1961, see entire document.	22
Y	US, A, 2,290,523 (BAUER) 21 July 1942, see entire document.	11, 22

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/08155

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/08155

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING
This ISA found multiple inventions as follows:

I. Claims 1-22 and 25-27, drawn to an in-line skate shoe and base construction.
II. Claims 23 and 24, drawn to an in-line skate brake.

The inventions listed as Groups I and II do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of Group I is the construction of the shoe portions and the attachment of the base to the frame; the special technical feature of Group II is the friction plate. Since the special technical feature of Group I is not present in the Group II invention and the special technical feature of the Group II invention is not present in the Group I invention, unity is lacking.